HPS® with müse®

User Guide

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Human Patient Simulator® (HPS ®) Software and User Guide

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(In accordance with EN 45014)

We,

Medical Education Technologies Inc.
6000 Fruitville Road
Sarasota, Florida 34232 USA

declare under our sole responsibility that the product,

Type of Equipment: Human Patient Simulator
with rack mount computer

Model Number: HPS

to which this declaration relates is in conformity with the following standards or other normative documents:

EMC: EN 55011:1998 / A1:1999 Group 1 Class A
EN 61326:1997 / A1:1998
EN 61000-4-2:1995
EN 61000-4-3:2002 / A1:2002
EN 61000-4-4:1995 / A1:2001 / A2:2001
EN 61000-4-5:1995
EN 61000-4-6:1996
EN 61000-4-11:1994
EN 61000-3-2:2000
EN 61000-3-3:1995 / A1:2001

following the provision of the EMC Directive 89/336/EEC.

Sarasota, Florida 34232 USA

Signature and Date

Carlos E. Moreno

Typed Name and Title

DIRECTOR OF ENGINEERING

European Contact:

HPS Specifications

Size

Mannequin	5 ft, 11 inches (180 cm)
Instructor Workstation	18.5″ H x 19.1″ W x 7.4″ D (46.9 cm x 48.5 cm x 18.9 cm)
Lab Rack	42.5″ H x 27″ W x 28″ D (108 cm x 69 cm x 71.2 cm)

Weight

Mannequin/Simulator	75 lbs (34 kg)
Lab Rack	256 lbs (159 kg)
Instructor Workstation	20 lbs (9.1 kg)

Environmental Requirements

Ambient Temperature Range

Operation	40°F to 104°F (4°C to 40°C)
Storage	40°F to 122°F (4°C to 50°C)

Maximum Altitude

Instructor Workstation

Maximum operating altitude:	10,000 ft
Maximum storage altitude:	10,000 ft
Maximum shipping altitude:	10,000 ft

Power

Rack & Mannequin

AC Input:	AC 100 – 220 VAC, 50/60 Hz
Consumption:	Approx. 400 W

Instructor Workstation

AC Input:	AC 100 – 240 VAC, 50/60 Hz

Electrotherapy

Defibrillation	Monophasic

Cautions/Warnings

Please read and understand these cautions and warnings before you begin using the HPS system.

USE OF THIS EQUIPMENT IN AN UNSPECIFIED MANNER MAY IMPAIR DESIGNED PROTECTION.

Your safety is in your hands. Be sure to follow the instructions on the proper setup, breakdown and use of the HPS system.

SHOCK HAZARD

Electrical Safety

- This product must be connected to an electrical outlet that is properly grounded. Precautions should be taken so that grounding or polarization is not defeated.
- Do not place defibrillator paddles on or adjacent to the ECG patient electrodes or the PACE patient electrodes. Contact between defibrillator paddles and the ECG/PACE electrodes may cause injury to the user and damage to the equipment.
- The HPS is tested to work with the Physio Control Model LifePak 11 monophasic defibrillator. The use of other defibrillators should be certified by CAE Healthcare prior to use.
- Do not attempt to disassemble the HPS Lab Rack or Portable Rack or service any of the electrical components.
- Operate the system from a power source with the following rating: 115VAC, 50/60 hertz (cycles per second) (e.g., North America, Japan).
- Be sure to use the appropriate 110 or 220 power plugs from the rack, depending on the poser characteristics of your location.
- Do not spill fluids of any kind in or on any piece of HPS/PediaSIM equipment.

General Use Warnings

Electrical System and HPS Rack

- Do not drop, step on or stack anything on the HPS rack.
- Do not clean the HPS Lab Rack front panel with chemical solvents. Use water and a light soap solution only.

Mannequin

- Do not disassemble factory-assembled parts of the mannequin.
- Apply water to the mannequin only in accordance with the supported clinical procedures identified in this User Guide.
- Make sure the mannequin is set up on a stable, sturdy work surface to avoid collapsing and causing injury to users.
- Do not introduce foreign substances into the airway, with the exception of small amounts of approved silicone-based lubricant.
- The HPS should be operated in ambient temperatures below 104˚ Fahrenheit (40˚ Celsius). Prolonged operation (more than two hours) in ambient temperatures greater than 104˚ Fahrenheit (40˚ Celsius) results in anomalous behavior and out of-spec performance.
- Only perform invasive procedures supported by the system as described in applicable sections of the User Guide.
- Do not pick the mannequin up by the limbs — support head and leverage weight with torso.
- It is essential to power off the entire HPS system before switching the mannequin from the adult patient mannequin to the pediatric patient mannequin for users with this option.
- Latex is contained within the HPS Mannequin in the vein assembly of the right arm (i.e., IV arm). Should you need to replace any portion of the vein assembly please take the necessary precautions.

Gases

- Follow the standard United States Department of Transportation, or applicable national agency's warnings and regulations for handling and using compressed gases.
- Use caution when engaging the air and medical gas valves.

Latex Warning

CAE simulators incorporate latex into their design. When performing certain maintenance procedures, the latex can become exposed. Users with latex sensitivity should take necessary precautions when handling the simulator while performing those procedures.

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Introduction

As the worldwide leader in patient simulation technology and education, CAE Healthcare is excited to introduce the Human Patient Simulator (HPS). With CAE Healthcare's proprietary human physiology model at its core, the HPS is designed to automatically determine patient responses to user interventions in real time.

HPS

What makes the HPS so unique is its versatility and usability. Combining intricate systems design and flexible user-oriented software, the HPS creates realistic learning experiences that replicate the complexities of human physiology with reactive eyes, heart and breath sounds, palpable pulses and a myriad of other features that mirror a true and accurate representation of the human body.

Contained in this User Guide

This User Guide has been designed for quick access to information on how to use and maintain the HPS system. Please be sure to read and follow the **Cautions and Warnings** on the pages preceding the **Table of Contents**. This is for the safety of users as well as for the protection of the simulator.

Before using the system, follow the step-by-step instructions included in the **HPS with Müse Setup** section.

The **Using the Software Section** section provides instructions on the use of the various software features as well as how to create and save a new patient.

The **Using HPS with Müse** section includes information on how the simulator and software components work and the functionality that each supports. Various clinical interventions are explained in this section, along with how these interventions isolate critically important learning objectives. In addition, detailed instructions are provided on how to develop and save custom patients.

The **Drug Recognition** section includes usage and orientation content to use this feature of the HPS system. This section also includes content pertaining to the use of the bar code reader.

The **Anesthesia and Scavenging** section applies to users with the optional anesthesia package. This section provides important usage instructions as well as scavenging guidelines to support the use of this optional equipment component.

The **PediaSIM HPS with Müse** section is available for users who purchased the HPS PediaSIM. The PediaSIM can be purchased as an accessory to the HPS system or as a stand-alone simulator. For the stand-alone user, all of the pertinent usage information as it pertains to the PediaSIM is included in this one complete section. For users using the PediaSIM as an accessory, this section provides a content overview to help orient the user to the system features and functionality.

The **HPS Care and Maintenance** section contains warranty details and cleanup and care instructions that must be followed to ensure optimal functioning of the HPS system.

Equipment Overview

The HPS is comprised of three main components - the HPS Lab Rack, the Instructor Workstation and the HPS mannequin. There are two configurations for the HPS: the Human Patient Simulator - HPS and the Health Science HPS.

Human Patient Simulator - HPS: Standard Equipment
HPS Mannequin
HPS Lab Rack
Desktop Instructor Workstation
Wireless Remote Control
Drug Recognition System
OxSim
Monitor Interface
Wireless Microphone and Receiver
Replacement Kit
Diagnostic Peritoneal Lavage

Human Patient Simulator - HPS: Optional Equipment
Tablet Instructor Workstation
TouchPro Monitor
Anesthesia Delivery System
Anesthesia Gas Accessory Kit
Gas Accessory Kit
Trauma/Disaster Casualty Kit (TDCK)
Moulage Kit
Tool Kit
PediaSIM Plug and Play Mannequin
METIVision
METI FX
Hands-Free Training Cables
HPS Learning Applications and Training Courses

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Health Science HPS: Standard Equipment
HPS Mannequin
HPS Lab Rack
Desktop Instructor Workstation
TouchPro Monitor
Wireless Microphone and Receiver
Replacement Kit
Diagnostic Peritoneal Lavage

Health Science HPS: Optional Equipment
Tablet Instructor Workstation
Wireless Remote Control
Drug Recognition System
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HPS Equipment

The descriptions on the following pages outline standard and optional components of the HPS system. *Refer to the **Human Patient Simulator - HPS: Standard Equipment** on page 4 or the **Health Science HPS: Standard Equipment** on page 5 for a list of standard components included with your system configuration.*

HPS Mannequin

All patient assessments and clinical interventions are played out on the HPS mannequin, which represents a human patient. At 5' 11" (180 cm) tall and weighing 75 pounds (34 kg), it is fully operational in the supine and lateral positions. It can be placed on a gurney, operating room table or on the ground. The mannequin offers features such as breath and heart sounds, palpable pulses, patient voice, genitourinary features and airway management features.

Umbilical Assembly

The Umbilical Assembly is a long, bundled system of hoses and an electrical cable attached to the HPS mannequin in the perineum area. The Umbilical Assembly attaches the mannequin to the HPS Lab Rack.

The Umbilical Assembly

The Umbilical Assembly is about 12 feet (4 meters) long and is made up of two bundled systems: the fluidic/pneumatic pigtail and the electrical pigtail. The large square electrical connector attaches to the back of the HPS rack, while each of the fluidic/pneumatic hoses attaches to labeled ports on the back of the rack.

HPS Lab Rack

The HPS Lab Rack is the hub of communication, power and pneumatics for the HPS system. It contains a central power supply, an Ethernet switch, lung bellows and other essential components that drive the simulator's physical responses.

HPS Lab Rack

The following descriptions explain the configuration of the HPS Lab Rack.

The Back of the Rack

The following components are exposed at the back of the rack:

MUX 6 - An open serial port. May be used to connect the TDCK.

MUX 10 - An open serial port.

Exhaust Port - Used for scavenging anesthetic gases.

Audio Out - Enables the simulator's audio outputs to be connected directly into an audio system.

NOTE: Only Heart Sounds are transmitted through the audio port. Sounds are monophonic.

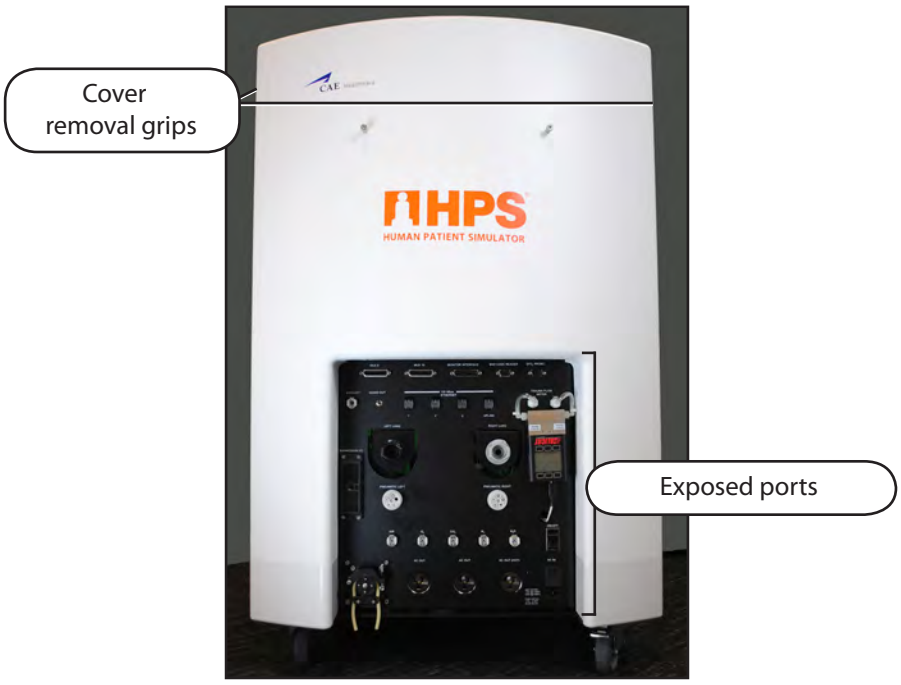
Genitourinary Pump - Forces water in and out of the mannequin through the system hoses.

SpO_2 Probe Port - Provides communication between the OxSim and the rack.

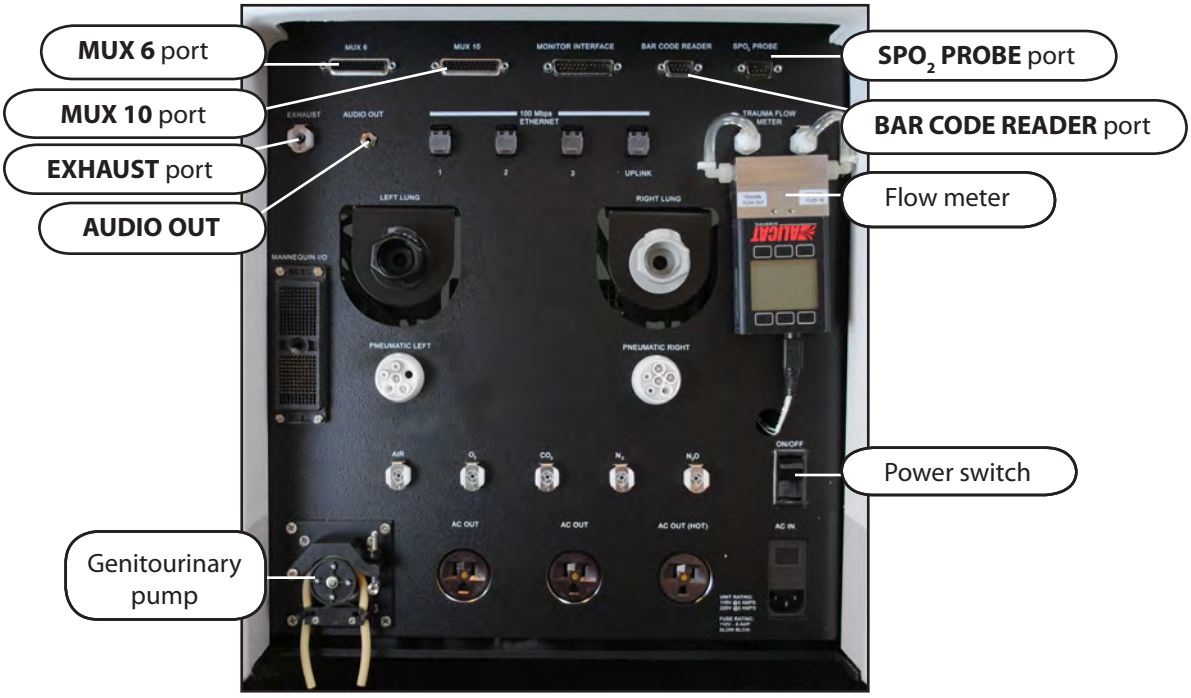
Bar Code Reader Port - Provides communication between the Bar Code Reader and the rack.

Flow Meter - Measures the flow of the fluid to the chest tube and pericardiocentesis features of the HPS.

Power Switch - Toggles simulator power on and off.

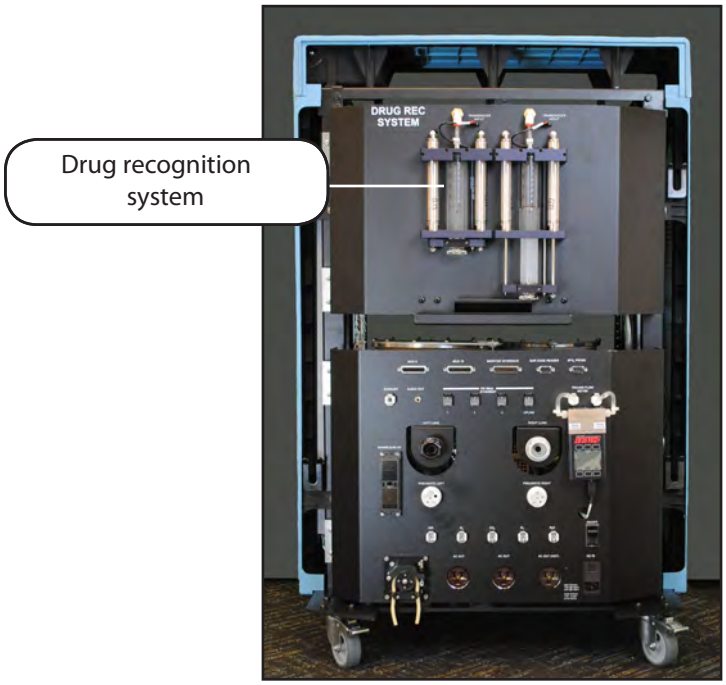


The Back of the Rack



The Exposed Ports at the Back of the Rack

The upper back of the rack also contains the drug recognition system, which measures the volume displaced when drugs are given and pushes fluids from the drug system into a collection bag. The upper back of the rack is covered by a plastic cover. To remove the cover, hold the grips on both sides of the cover and pull up, then out.



The Back of the Rack with the Cover Removed

The Front of the Rack

The front of the rack is protected by a plastic cover. To remove the cover, hold the grips on both sides and pull up, then out.

Front of Rack with Cover in Place

The following components can be accessed from the front of the rack:

Sim Cube* - Processes noninvasive blood pressure (NIBP) data from the software and drives the mannequin's physical responses so patient monitoring equipment may be used to measure NIBP.

Syringe Pump - Installed in the rack when the anesthesia system option is in place. Delivers liquid anesthetic agents to a vaporizer before they are sent to the mannequin, providing a realistic exhalation of agents. The syringe pump can also be accessed via the anesthesia delivery system panel (see *The Anesthesia Delivery System Panel* on *page 13*).

Vaporizer - Installed in the rack when the anesthesia system option is in place. Evaporates anesthetic agents before sending them to the mannequin.

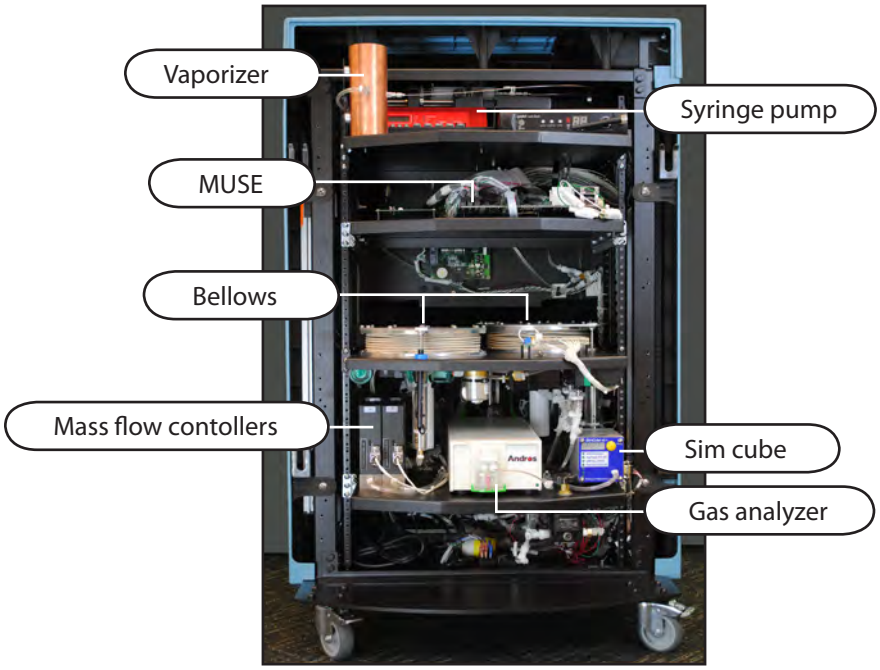
Bellows - Provide the lung functionality of the HPS system.

Mass Flow Controllers (MFCs) - Control the flow of O_2, CO_2, N_2 and N_2O to the mannequin.

Gas Analyzer - Analyzes the gases going into and flowing out of the mannequin.

MUSE Universal Simulator Engine Circuit Boards - Control various components of the rack.

**Optional for Health Science HPS, standard for Human Patient Simulator - HPS*



Front of Rack with Cover Removed

IMPORTANT: Do not alter or modify the settings of any of the components inside the rack except the Syringe Pump and Vaporizer. Doing so affects performance.

The Anesthesia Delivery System Panel

The anesthesia delivery system is optional for the Health Science HPS and the Human Patient Simulator - HPS. When the anesthesia delivery system is installed, the syringe pump can be easily accessed from the panel at the top of the rack.

The Anesthesia Delivery System Access Panel

NOTE: The Anesthesia Delivery System is optional. If the system is not installed on your simulator, the access panel reveals only an empty bracket.

Desktop Instructor Workstation

The Desktop Instructor Workstation is a desktop computer that utilizes the Müse Software to operate as the main simulation control center.

The computer runs the underlying mathematical models that generate the physiological data that is realized on the simulator. Instructors control the simulator session from the workstation by selecting Simulated Clinical Experiences (SCEs) that meet the objectives of the training module.

IMPORTANT: All CAE Healthcare computer components are preconfigured for use with the HPS system. There are no software installation or configuration steps required. Only approved CAE Healthcare applications should be installed or run on the HPS computer system.

Wireless Remote Control

Optional for Health Science HPS

The Wireless Remote Control can be used when the use of an Ethernet cable and a power cord is restrictive. It is preconfigured with the same software and functions in the same way as the Instructor Workstation (product #HPS-501).

TouchPro Monitor

Optional for Human Patient Simulator - HPS

The optional TouchPro Monitor is a flat-panel, touchscreen monitor that connects wirelessly to the Instructor Workstation and is used to run the TouchPro software.

Drug Recognition System

Optional for Health Science HPS

The HPS and PediaSIM both incorporate barcode technology along with an extensive drug library as part of the drug administration learning features. This system gives practicing clinicians a safe environment to learn drug administration prior to working on real human patients. The Enhanced Drug Recognition system (product #HPS-401) is a complete package that includes the following:

- The Barcode Reader (or Stopcock Manifold)
- Three Sheets of Barcode Labels

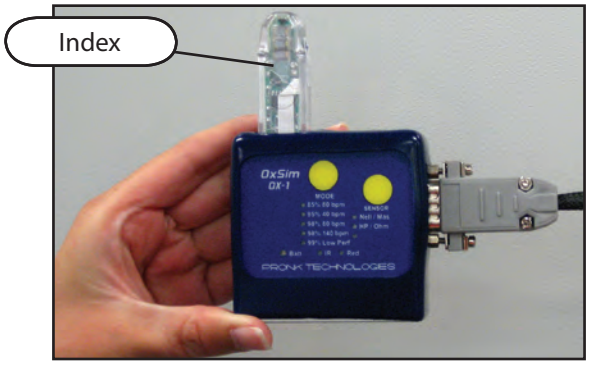
NOTE: The remaining components, including an IV bag with distilled water, two stake sets, an empty IV bag and 10 mL, 2 mL or 50 mL syringes are all user-supplied.

The individual barcode labels identify a complete library of drugs from a wide range of classifications. When appropriately applied to a syringe, each label uniquely identifies the drug and concentration to the HPS system using the barcode reader (or Stopcock Manifold). The Stopcock Manifold electrically connects to the back of the rack and to the IV access ports on the patient mannequin.

OxSim

Optional for Health Science HPS

The OxSim is used to provide SpO_2 data to the monitoring equipment used during the simulation session. A standard SpO_2 finger probe can be placed on the Index to obtain an SpO_2 reading for a virtual patient.



OxSim

Monitor Interface

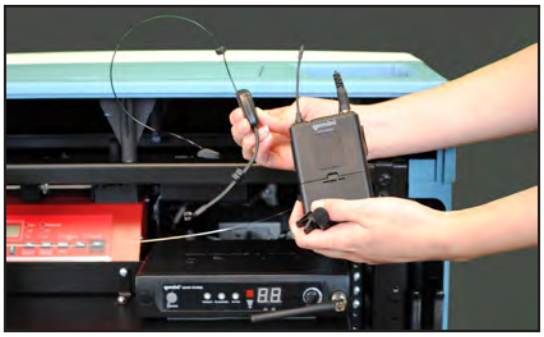
Optional for Health Science HPS

The monitor interface is used to connect the simulator to a standard clinical monitor, allowing for the display of a wide range of patient parameters (product #MI-001).

Monitor Interface

Wireless Microphone and Receiver

The wireless microphone and receiver are used for the patient voice feature of the HPS system. The receiver is housed inside the rack. The wireless microphone includes an adjustable lapel clip, volume control and mute.



Wireless Microphone and Receiver

Replacement Kit

The Replacement Kit includes the IV Arm Kit, Trauma Features Kit, Airway Kit and Genitourinary (GU) Kit. The items contained in each kit are listed below.

IV Arm Kit

- Venous Tubing Splicing Kit
- 140 mL syringe and IV solution sets

Trauma Features Kit

- Chest tube foam inserts
- Chest tube receptacles
- Chest tube priming hose
- Diagnostic peritoneal lavage abdominal insert
- Standard abdominal insert

Airway Kit

- Spare neck skins
- Silicone spray
- Spool of red airway tape

Genitourinary (GU) Kit

- Interchangeable male/female genitalia
- IV solution set

Diagnostic Peritoneal Lavage

The Diagnostic Peritoneal Lavage (DPL) abdominal cavity allows for the performance of DPL on the mannequin and is interchangeable with the standard abdominal cavity. The DPL cavity has a slit down the center and can be filled with distilled water tinted with red food coloring. When tape is placed over the slit in the cavity and a needle is placed in it, fluid is aspirated back similar to when DPL is performed in the clinical setting.

Tablet Instructor Workstation

Optional for Human Patient Simulator - HPS and Health Science HPS

The Tablet Instructor Workstation is an optional, ruggedized tablet computer that can be used instead of the Desktop Instructor Workstation to run the Müse software. An additional Müse license is provided with this option.

NOTE: The Tablet Instructor Workstation cannot perform calibration utilities. The Desktop Instructor Workstation is needed to perform these functions. Additionally, the Tablet Instructor Workstation and the Desktop Instructor Workstation cannot be used at the same time. Müse content is not shared between the Tablet and Desktop Instructor Workstations.

Anesthesia Delivery System

Optional for Human Patient Simulator - HPS, not included with Health Science HPS

The Anesthesia Delivery System is optional for the Human Patient Simulator - HPS configuration. It can be installed in the HPS Lab Rack and allows for the use and detection of real anesthetic agents (product #HPS-300).

Anesthesia Gas Accessory Kit

Optional for Human Patient Simulator - HPS, not included with Health Science HPS

The Anesthesia Gas Accessory Kit is optional for the Human Patient Simulator - HPS configuration. The kit contains regulators and hoses to connect carbon dioxide, oxygen, air, inert gas and carbon dioxide to the HPS Lab Rack, along with the components necessary to connect the HPS Lab Rack to a scavenging system (product #GAS-002).

Gas Accessory Kit

Optional for Human Patient Simulator - HPS and Health Science HPS

The optional Gas Accessory Kit contains regulators and hoses to connect carbon dioxide, oxygen, air and inert gas tanks to the HPS Lab Rack (product #GAS-001).

Trauma/Disaster Casualty Kit (TDCK)

Optional for Human Patient Simulator - HPS and Health Science HPS

The TDCK adds to the fidelity of a training session by providing the means to add the automatic, software-controlled flow of blood, mucous and secreted fluids from the mannequin (product #TF-005).

The Trauma Disaster Casualty Kit

Moulage Kit

Optional for Human Patient Simulator - HPS and Health Science HPS

The Moulage Kit is available separately or as part of the Trauma Disaster Casualty Kit.

Moulage Kit

The Moulage Kit is used to simulate injuries and trauma (product #MODS-999).

Tool Kit

Optional for Human Patient Simulator - HPS and Health Science HPS

To simplify common adjustments and periodic repairs, CAE Healthcare has put together a kit containing tools selected for use with the simulator (product #TOL-001).

The Tool Kit

PediaSIM Plug and Play Mannequin

Optional for Human Patient Simulator - HPS and Health Science HPS

The optional PediaSIM Plug and Play Mannequin can interface with either of the HPS models to simulate the unique physiology of a pediatric patient (product #HPS-016).

PediaSIM Plug and Play Mannequin

METIVision

Optional for Human Patient Simulator - HPS and Health Science HPS

METIVision is a fully integrated, digital audio-visual management system that is data-synchronized in real-time for use with CAE Healthcare simulators. METIVision is the only solution available with the capability to not only capture and store simulation data, but to also broadcast and review any medical simulation exercise using CAE Healthcare simulators. Complete with physiologic data logs, event logs, pharmacology logs and patient monitoring data, METIVision offers the capability to provide a complete record of simulation exercises for debriefing, assessment and evaluation (product #MTV-001).

METIVision Console

METI FX

Optional for Human Patient Simulator - HPS and Health Science HPS

CAE Healthcare takes realism to the next level with METI FX, a realistic set for advanced moulage wound simulation and special effects. METI FX includes incredibly lifelike wounds that accurately replicate muscle, tissue and subcutaneous fat and reflect the true physical nature of a wound and its treatment. METI FX comes complete with CAE Healthcare's own educational learning tools – a set of how-to treatment cards explaining procedures and learning objectives for both civilian and military patient scenarios (product #MFX-100).

METI FX Simulation

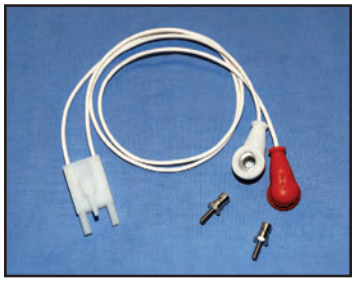
Hands-Free Training Cables

Optional for Human Patient Simulator - HPS and Health Science HPS

Hands-Free Training Cables connect to most popular defibrillators and cardiac pacing units and take the place of non-reusable electrode pads.

Three different cable designs are available to support the most popular defibrillation and pacing equipment. Each cable kit includes posts that attach to the defibrillator or pace locations on HPS.

Zoll (Zoll Medical Corporation)



(product #ACC-006)

Physio-Control (Medtronic, Inc.)

(product #ACC-007)

Philips (Koninklijke Philips Electronics, N.V.)

(product #ACC-008)

HPS with Müse Learning Applications and Training Courses

HPS with Müse Learning Applications

Learning applications enhance the use of the simulator by providing preprogrammed scenarios and corresponding support documentation (e.g., course objectives, instructor's notes) that can be readily integrated into a lesson plan, a specific curriculum or an educational program. The following Learning applications are available for HPS with Müse.

Advanced Cardiac Life Support (ACLS)

Adult Nursing

Cardiopulmonary Critical Situations (CCS)

Disaster Medical Readiness (DMR)

Emergency Medical Services (EMS) Learning Application 1

Emergency Medical Services (EMS) Learning Application 2

Emergency Medical Services (EMS) Learning Application 3

Emergency Medical Services (EMS) Learning Application 4

Foundations of Nursing Practice

Patient-Centred Acute Care Training (PACT) Simulation

Pediatric Advanced Life Support (PALS) for PediaSIM

Pediatric Emergencies

Pediatric Nursing

Perioperative Management

Program for Nursing Curriculum Integration (PNCI)

Program for Nursing Curriculum Integration (PNCI)

Respiratory Education Simulation Program (RESP) Learning Application 1

Respiratory Education Simulation Program (RESP) Learning Application 2

Respiratory Education Simulation Program (RESP) Learning Application 3

Tactical Medical Care (TMC)

HPS with Müse Training Courses

HPS Basic and Advanced courses offer learners at all levels in-depth instruction in the setup, operation, development of scenarios and maintenance related to the use of the HPS.

The HPS Basic course provides learners with an overview of the system and its components, as well as an introduction to patient creation and scenario design.

HPS Basic - two days at CAE Healthcare facility

HPS Basic On-Site - two days at learner-defined facility

HPS Basic On-Site Physician Instructor - two days at learner-defined facility with physician-led instruction

The HPS Advanced course builds upon the concepts introduced in the prerequisite Basic course. After a quick review of the Basic course, Advanced instruction spends the majority of the two days providing learners with the ability to design patients and scenarios that can be used immediately upon completion of the course.

HPS Advanced - two days at CAE Healthcare facility

HPS Advanced On-Site - two days at learner-defined facility

HPS Advanced On-Site Physician Instructor - two days at learner-defined facility with physician-led instruction

HPS with Müse Setup

The following pages guide you through assembling and configuring HPS. Below is a list of the steps required to prepare HPS for operation.

	Setting Up HPS
1	Place the Simulator in the Work Area
2	Connect the Umbilical Assembly
3	Connect the Gases
4	Connect the Instructor Workstation
5	Connect the OxSim (Optional)
6	Connect Clinical Monitors (Optional)
7	Ensure all Gas Supplies Are Turned Off
8	Turn on Patient Monitors and Other Clinical Equipment
9	Power on the HPS Lab Rack
10	Power on and Log into the Instructor Workstation
11	Activate the Gas Supplies
12	Launch Müse

Before Beginning Setup

Proper operation of the HPS simulator requires the correct configuration. Before setting up the system, keep in mind these basic guidelines:

Understand the Cautions/Warnings information included in the beginning of this User Guide.

Follow the sequence of steps carefully,

Complete all steps in order, and

Do not power on any components until instructed in the text.

KEEP all original shipping materials, including the BOXES. Warranty and repair items must be return-shipped to CAE Healthcare in their original packaging.

Because shipping materials should be stored and retained, be sure all protective packing materials and unused ancillary computer parts are secured.

If unpacking HPS for the first time, careful use of a box cutter protects both the packaging and the product.

The Setup Map and Quick Start Chart cover these same steps in abbreviated fashion.

Step 1: Place the Simulator in the Work Area

Select a work area with enough room for all equipment, providing ample space for easy access to the simulator. At least a 12' x 14' (3.5 meter x 4.5 meter) work area is recommended for movement of learners and positioning of standard components around the simulator. If you are using optional items such as anesthesia, drug recognition, Wireless Remote Control or TDCK, you need to allow additional room for those components.

The HPS Mannequin

Make sure a multi-plug AC power outlet exists within the workspace to power the HPS Lab Rack, Instructor Workstation and monitoring equipment.

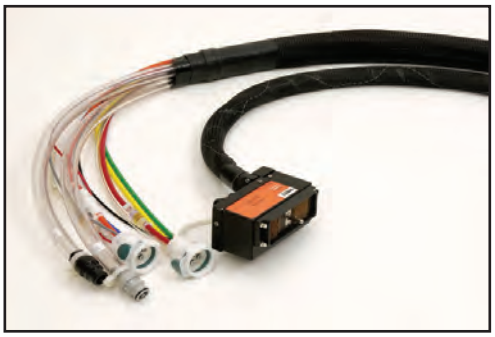
Before placing the simulator on a surface, be certain the surface can easily support 75 pounds (34 kg).

NEVER lift the mannequin by the LIMBS. Leverage the torso of the simulator and support the head while lifting.

NOTE: Be sure to use the appropriate 110 or 220 power plugs from the rack, depending on the power caracteristics of your location.

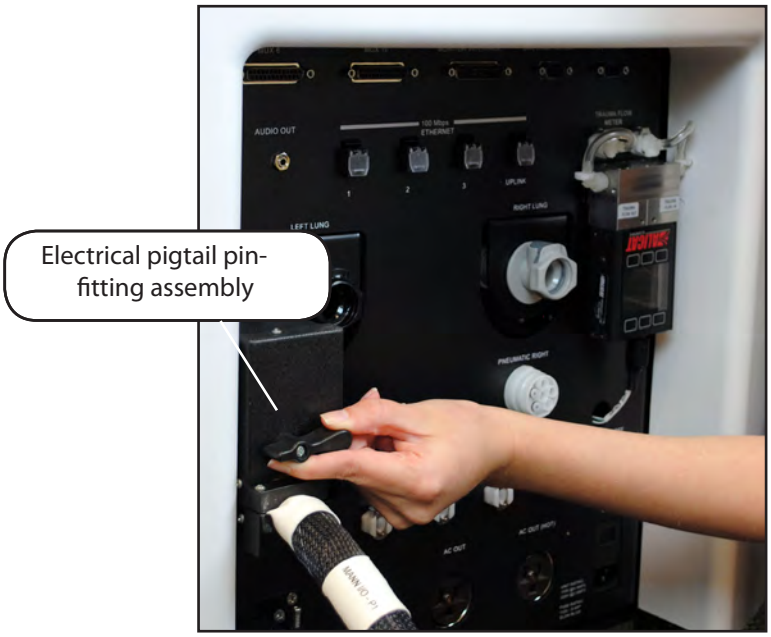
Step 2: Connect the Umbilical Assembly

a. Locate the long bundled system of fluidic/pneumatic hoses and an electrical pigtail attached to the mannequin in the perineum area. This is the umbilical assembly.



The Umbilical Assembly

b. Attach the pin-fitting assembly on the electrical pigtail to the back of the HPS Lab Rack, being careful not to bend any of the pins.

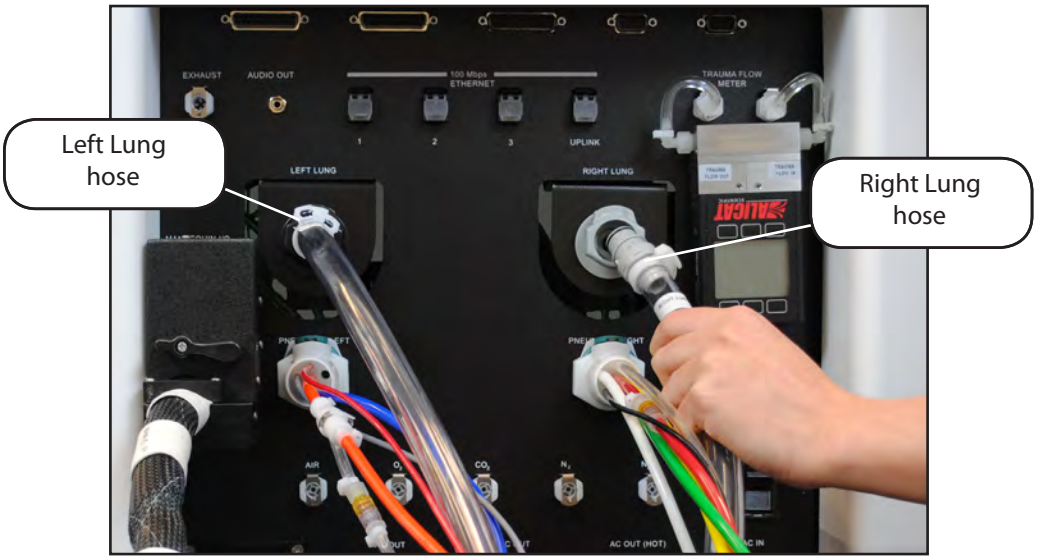


Attaching the Electrical Pigtail

c. Attach the Pneumatic Left and Pneumatic Right hoses to the labeled ports on the back of the HPS Lab Rack.

Attaching the Pneumatic Left and Pneumatic Right Hoses

d. Attach the Left Lung and Right Lung hoses to the labeled ports on the back of the HPS Lab Rack.



Attaching the Left Lung and Right Lung Hoses

Step 3: Connect the Gases

In order to use the HPS, Compressed Air, Oxygen (O_2), Carbon Dioxide (CO_2) and Nitrogen (N_2) must be supplied via central air source or cylinder size G, H or K. Nitrous Oxide (N_2O) may also be supplied for anesthesia delivery if desired. All gases must be calibrated to 50 psig/345 kPa.

a. Ensure the supply pressure of all gas tanks and the Compressed Air tank are set to 50 psig/345 kPa.

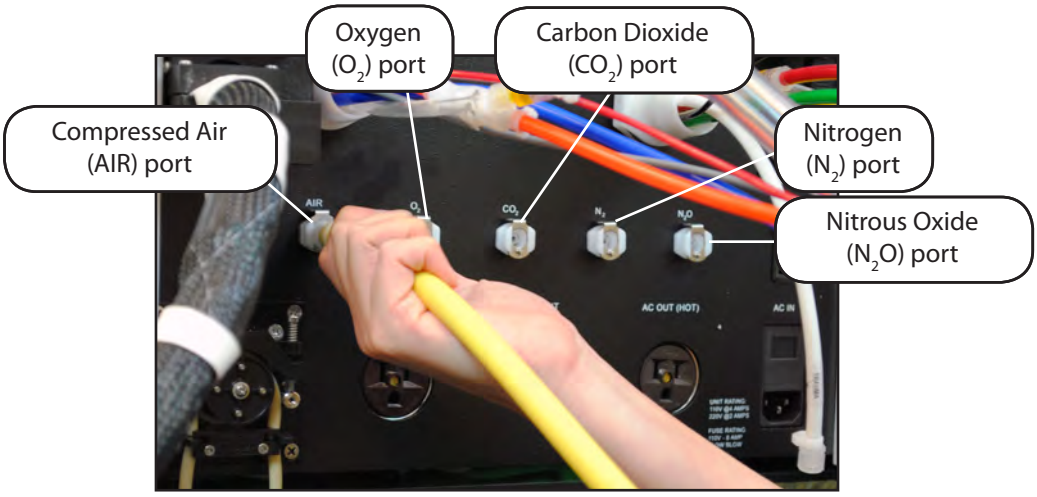
b. Connect Compressed Air to the labeled port on the back of the HPS Lab Rack.

c. Connect Oxygen (O_2) to the labeled port on the back of the HPS Lab Rack.

d. Connect Carbon Dioxide (CO_2) to the labeled port on the back of the HPS Lab Rack.

e. Connect Nitrogen (N_2) to the labeled port on the back of the HPS Lab Rack.

f. Connect Nitrous Oxide (N_2O) to the labeled port on the back of the HPS Lab Rack (Optional).



Connecting the Gases to the Back of the HPS Lab Rack

IMPORTANT: DO NOT turn on the gases until instructed in *Step 11* on page 36.

Step 4: Connect the Instructor Workstation

a. Place the Desktop or Tablet Instructor Workstation at the location where it will be used.

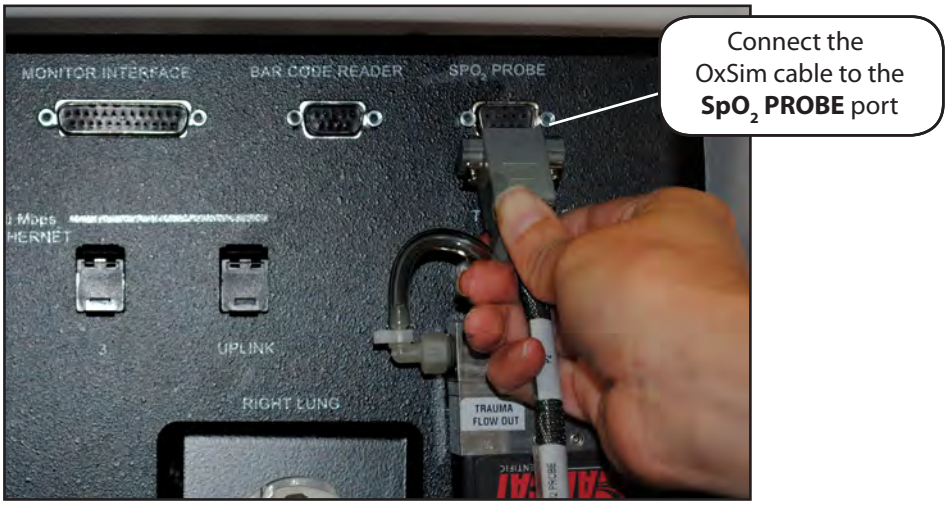
b. Connect one end of the Ethernet cable to the Instructor Workstation.

c. Connect the other end of the Ethernet cable to the HPS Lab Rack.

Connecting the Ethernet Cable to the HPS Lab Rack

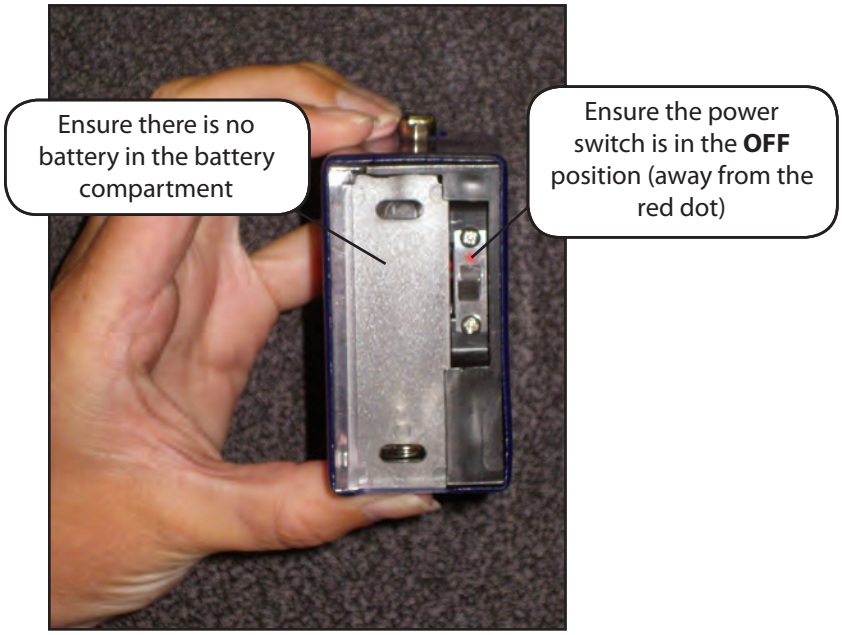
Step 5: Connect the OxSim (Optional)

a. Connect the OxSim cable to the **SpO_2 PROBE** port on the back of the rack.



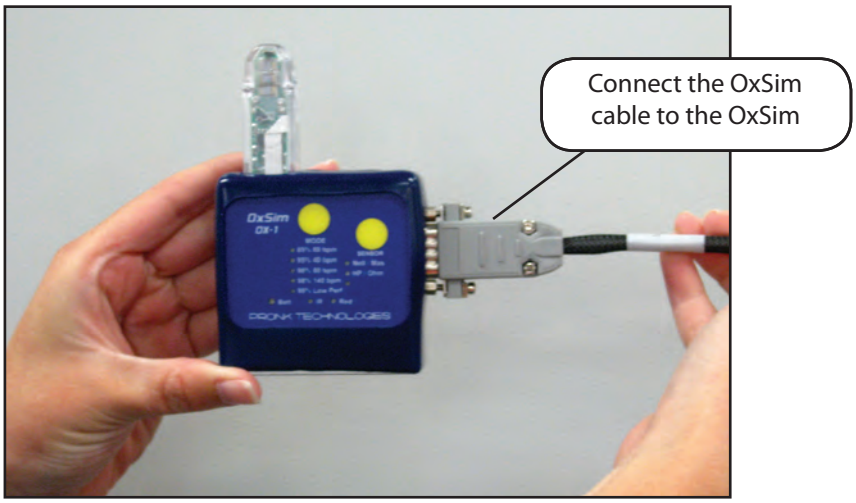
Connecting the OxSim cable to the Back of the Rack

b. Ensure there is no battery in the OxSim and the power switch is in the **OFF** position (away from the red dot).


Ensure there is no battery in the battery compartment
Ensure the power switch is in the **OFF** position (away from the red dot)

The OxSim Battery Compartment and Power Switch

c. Connect the other end of the OxSim cable to the OxSim.



Connecting the OxSim Cable to the OxSim

NOTE: It is recommended that the OxSim be secured to a patient monitor, anesthesia machine, equipment rack or other secure surface using a hook-and-loop fastener such as Velcro®.

Step 6: Connect Clinical Monitors (Optional)

a. Connect the pin-connector end of the Monitor Interface to the back of the rack, securing the pin-connector into place with the screws.

Connecting the Monitor Interface to the Back of the Rack

b. Connect the standard monitor cables to the six labeled sections at the remaining end of the Monitor Interface. The monitor now interfaces with the HPS as it does with a real patient.

Connecting Standard Monitor Cables to the Monitor Interface

Step 7: Ensure All Gas Supplies Are Turned Off

Before proceeding, ensure all gas supplies connected to the HPS Lab Rack are turned off.

Step 8: Turn on Patient Monitors

Turn on all patient monitors.

Step 9: Power on the HPS Lab Rack

Connect the power cord to the rack and to an AC power source, then turn on the power switch located in the lower right corner on the back of HPS Lab Rack.

The Back of the HPS Lab Rack

Step 10 - Option 1: Power on and Log into the Desktop Instructor Workstation

a. Power on the Desktop Instructor Workstation by pressing the Power button located on the back side of the Instructor Workstation monitor panel.

b. In most instances, the Instructor Workstation automatically logs into the HPS User account. In this case, the user doesn't need to take any further action to log into the Instructor Workstation.

   In some instances (e.g., when a user has manually logged out of the HPS User account), a small Users window appears, displaying two choices: **Administrator** and **HPS User**. In this case, proceed to step 10c.

c. Select **HPS User**.

   The Login window opens, displaying the **Password** field.

d. Enter *hps* in the **Password** field.

e. Click **Log In** or press the **return** key on the keyboard.

Step 10 - Option 2: Power on and Log into the Optional Tablet Instructor Workstation

Power on the Tablet Instructor Workstation by pressing the Power button on the side of the tablet computer. The computer automatically logs in and the desktop appears."

If the computer does not automatically log in, enter the Username *METI User* and leave the Password field blank.

Step 11: Activate the Gas Supplies

a. Remove any artificial airway devices from the HPS mannequin.

b. Open the Compressed Air tank. Ensure the supply pressure is set to 50 psig/345 kPa.

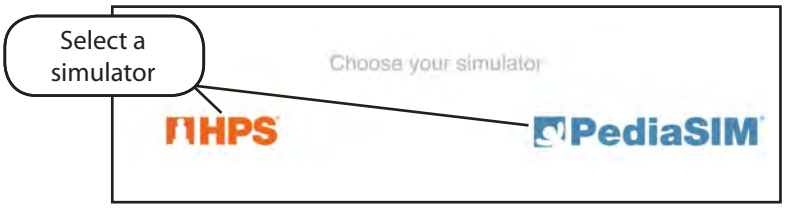
c. Open the O_2, CO_2, N_2 and N_2O (optional) air tanks. Ensure the supply pressures are set to 50 psig/345 kPa.

Step 12: Launch Müse

a. Using the Desktop or Tablet Instructor Workstation, launch the web browser (e.g., Safari, Internet Explorer).

   The Simulator Selection screen appears.

b. From the Simulator Selection screen, select a simulator.



Selecting a Simulator

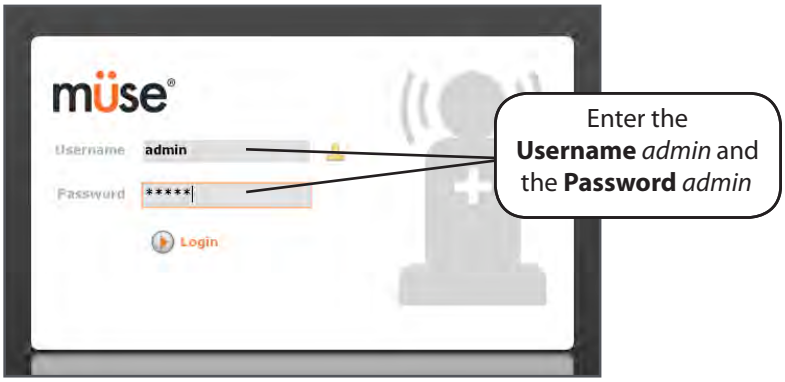
The Müse Start screen appears.

c. From the Müse Start screen, select **Müse**.

Selecting Müse

The Login screen appears.

d. On the Login screen, enter the **Username** *admin* and the **Password** *admin* in the appropriate fields to access Müse.



Entering the Username and Password

Müse opens to the Home page by default.

NOTE: Each time you launch Müse, CAE Healthcare recommends starting a Simulated Clinical Experience (SCE), letting the SCE run for two minutes, and then closing the SCE before proceeding. Running and closing the initial SCE prepares the system for accurate clinical behavior moving forward. *For information about running an SCE, see* ***Running an SCE*** *on page 59.*

Configuring a TouchPro or Wireless Remote Computer

The HPS network supports up to four computers: the Instructor Workstation, and three additional computers (a Wireless Remote computer and two TouchPro workstations). *All computers must meet the system requirements mapped out in the **System Requirements** section on page 46 of this User Guide.*

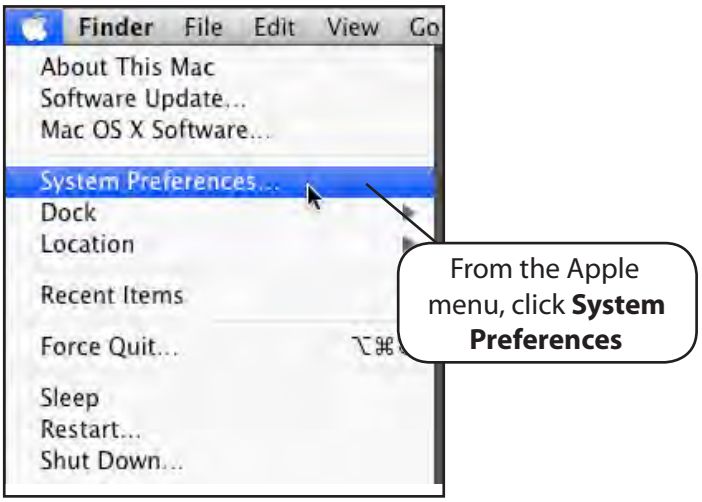
Follow the steps below to be able to use the Müse or TouchPro software on either a TouchPro computer or Wireless Remote computer.

Step 1: Set Up the HPS

The HPS simulator must be set up and powered on, and the Instructor Workstation must be connected to the HPS Network via the Ethernet connection to the Rack. *For directions on how to set up the HPS, refer to page 25 of this User Guide.*

Step 2: Obtain the IP Address from the Desktop Instructor Workstation

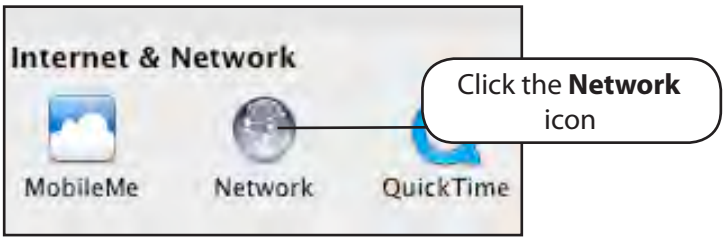
a. On the Macintosh Instructor Workstation connected to the HPS Network, from the **Apple** menu, click **System Preferences.**



Accessing the System Preferences

The System Preferences dialog box appears.

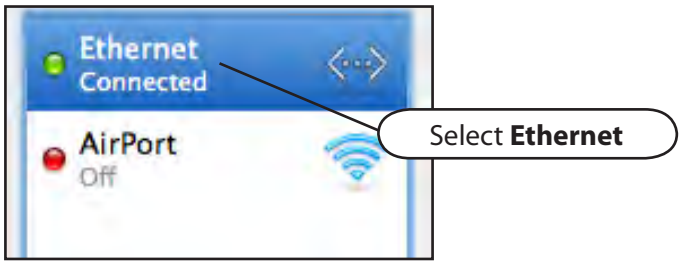
b. On the System Preferences dialog box, click the **Network** icon.



Clicking the Network Icon

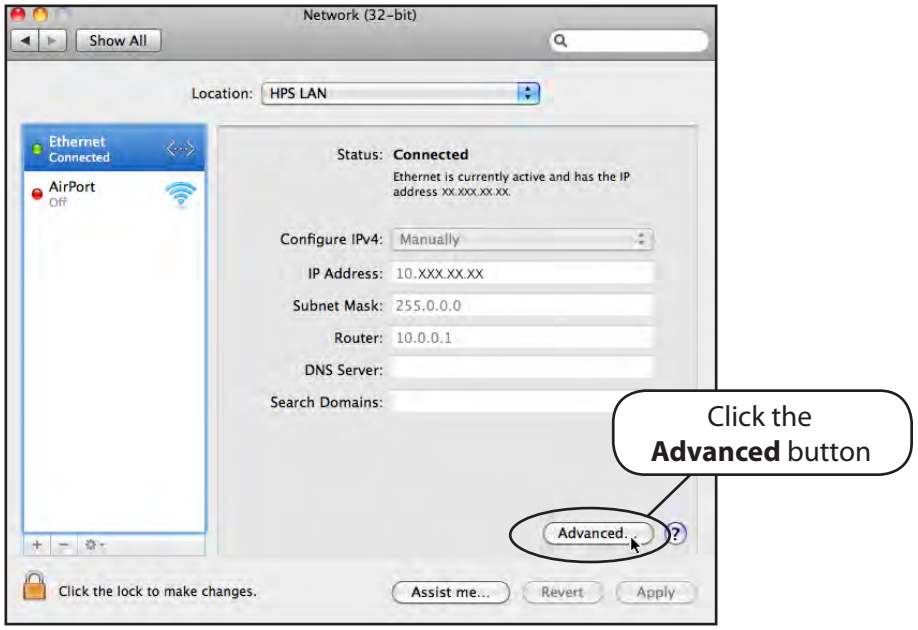
The Network dialog box appears.

c. On the panel on the left side of the Network dialog box, select **Ethernet** and ensure it is connected.



Select Ethernet

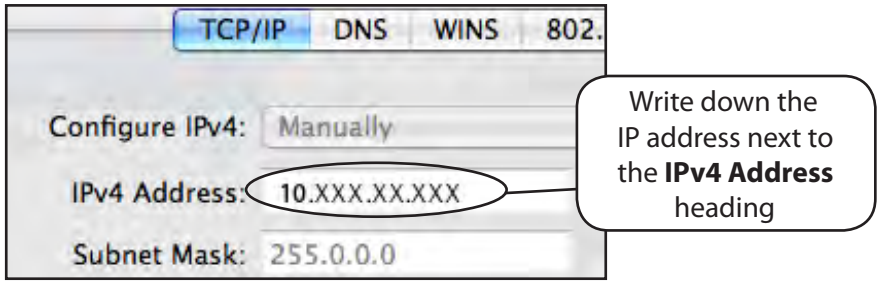
d. From the bottom, right-hand corner of the Network dialog box, click the **Advanced** button.



Clicking the Advanced Button

The TCP/IP Network screen appears.

e. Write down the IP address next to the **IPv4 Address** heading.



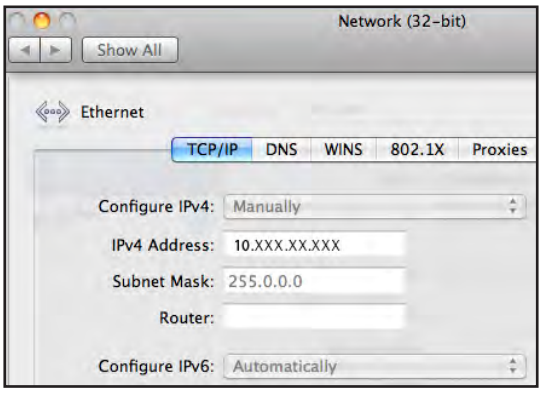
The Instructor Workstation's IP Address

f. Click **Cancel** to close the TCP/IP Network screen.

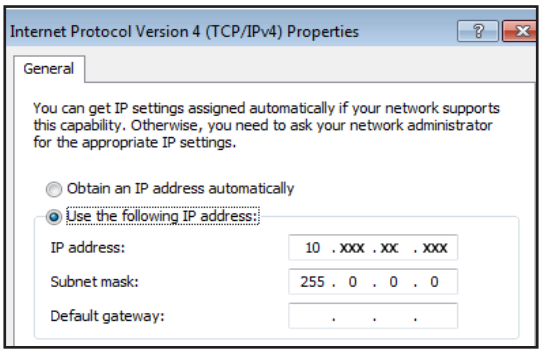
g. Close the Network settings screen.

Step 3: Configure the Wireless Remote/TouchPro Computer's Network Settings

a. Access the Networking screens (the TCP/IP settings screens) for your operating system. If you are unfamiliar with these screens, contact your Network Administrator or CAE Healthcare Customer Service (1-866-462-7920) for help with this step.



TCP/IP Network Screen – Macintosh


Internet Protocol Version 4 (TCP/IPv4) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
10 . xxx . xx . xxx
Subnet mask:
255 . 0 . 0 . 0
Default gateway:

Internet Protocol Version 4 (TCP/IPv4) Properties Screen – Windows

b. Choose **Configure IPv4 Manually** (Macintosh) or **Use the following IP address** (Windows).

c. In the **IPv4 Address** or **IP address** field, enter a unique IP address. The IP address must match the IP address obtained in **Step 2** EXCEPT for the number after the third and final period. This number can be any number between 2 and 254 BUT must be different from the final number of the IP address of the Instructor Workstation and any other computers on the network. No two IP addresses can be the same, including the Instructor Workstation's IP address.

Example: If the IP address of your Instructor Workstation is 10.127.91.223, you could assign the TouchPro computer the IP address 10.127.91.224 and the Wireless Remote computer the IP address 10.127.91.225.

d. In the **Subnet Mask** field, enter 255.0.0.0

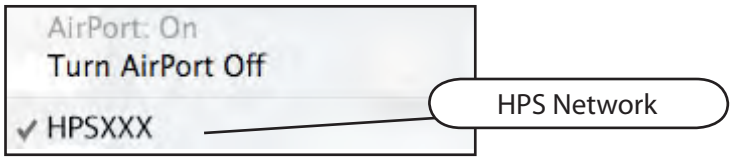
e. Click **OK** or **Apply** to save the changes.

Step 4 – Option 1: Join the HPS Network Using a Macintosh Operating System

a. Click the **AirPort** icon located at the top, right-hand corner of the screen of the TouchPro or Wireless Remote Computer.

A list appears with the HPS network listed.

b. Select the **AirPort** network labeled *HPSXXX* (where "XXX" is the unit number of your HPS).



Selecting the HPS Network

An Airport dialog box appears requesting the password for the HPS network.

c. Enter the password. *** See the note at the end of this step.*

d. Click **OK**.

Clicking OK

The computer has joined the HPS network. You can now proceed to **Step 5**.

***Depending on your HPS's router, your password has either six or eight characters. If the password contains six characters, the password is HPS, followed by three numbers. The numbers are the HPS unit number preceded by the number of zeros required to make the password total six characters. (Examples: HPS123 or HPS012, where 123 or 12 is the HPS unit number.)*

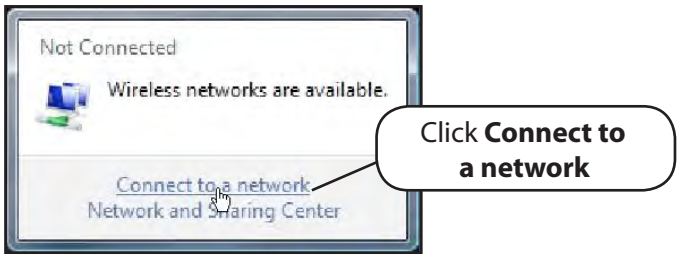
If the password contains eight characters, the password is HPS, followed by five numbers. The numbers are the HPS unit number preceded by the number of zeros required to make the password total eight characters. (Examples: HPS01234, HPS00123 or HPS00012, where 1234, 123 or 12 is the HPS unit number.) The password is case sensitive, and HPS is typically all capital letters.

Step 4 – Option 2: Join the HPS Network Using a Windows Operating System

a. Click the **Wireless Network** icon located in the bottom, right-hand corner of the screen of the TouchPro Computer.

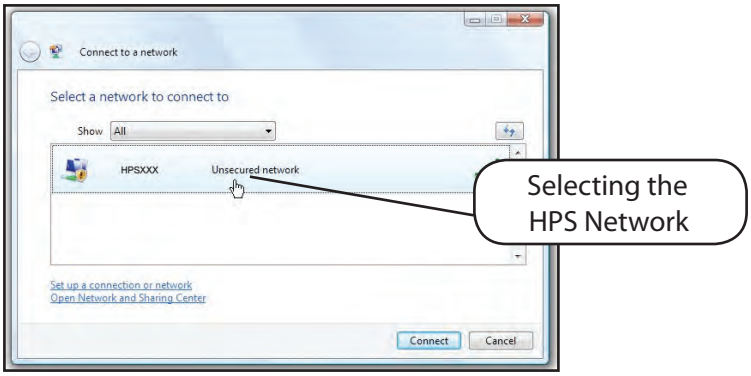
Clicking the Wireless Network Icon

b. Click **Connect to a network**.



Clicking Connect to a Network

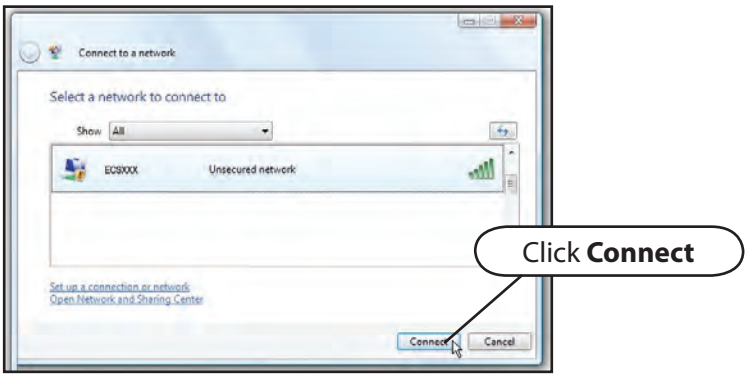
c. Select the network labeled *HPSXXX* (where "XXX" is the unit number of your HPS).



Selecting the HPS Network

d. Enter the Password. ** *See note at the end of this step.*

e. Click **Connect**.



Clicking Connect

The computer has joined the HPS network. You can now proceed to **Step 5**.

***Depending on your HPS's router, your password has either six or eight characters. If the password contains six characters, the password is HPS, followed by three numbers. The numbers are the HPS unit number preceded by the number of zeros required to make the password total six characters. (Examples: HPS123 or HPS012, where 123 or 12 is the HPS unit number.)*

If the password contains eight characters, the password is HPS, followed by five numbers. The numbers are the HPS unit number preceded by the number of zeros required to make the password total eight characters. (Examples: HPS01234, HPS00123 or HPS00012, where 1234, 123 or 12 is the HPS unit number.) The password is case sensitive, and HPS is typically all capital letters.

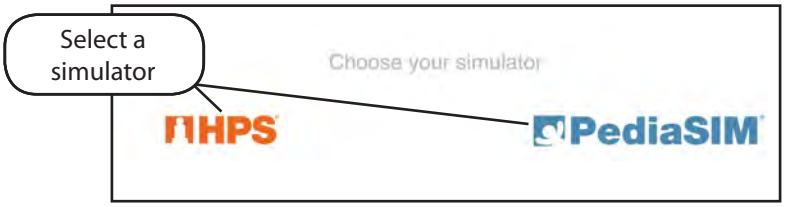
Step 5: Access the Software from the TouchPro or Wireless Remote Computer

a. On the TouchPro computer or Wireless Remote computer, launch the web browser, (e.g., Safari®).

b. Enter the IP address obtained in **Step 2** into the browser's address field.

The Simulator Selection screen appears.

c. From the Simulator Selection screen, select a simulator.



Selecting a Simulator

The Müse Start screen appears.

The Müse Start Screen

The Müse software or the TouchPro software can now be launched, and the software can be used in the same fashion as on the Instructor Workstation.

OPTIONAL: From your web browser, a bookmark can be created on the TouchPro or Wireless Remote computer for ease of access to the Müse or TouchPro software. Please consult your web browser's help menu for aid in creating a bookmark.

IMPORTANT: The Instructor Workstation MUST remain on and connected to the HPS network for the Wireless Remote or TouchPro computers to be able to operate.

System Requirements

If you are not using a TouchPro computer or Wireless Remote provided by CAE Healthcare, please be sure to utilize a computer with wireless capability. When operating the TouchPro or Müse software, a computer with a Macintosh® or Microsoft Windows® operating system may be used.

To run the TouchPro or Müse software, the computer used must meet the following minimum requirements:

Macintosh® Operating System

- Mac OS X 10.5.8 (minimum)
- Safari® 5.x.x or Firefox® 10 ESR (minimum)
- Adobe Flash Player® 10.1.x.x (minimum)
- Adobe Reader 9.x (or higher)

Windows® Operating System

- XP Service Pack 2, Vista, Windows 7 or Windows 8
- Firefox® 10 ESR, Internet Explorer® 8 or Safari 5.x.x (minimum)
- Adobe Flash Player® 10.1.x.x (minimum)
- Adobe Reader 9.x (or higher)

Hardware (Windows and Macintosh)

- Intel Core Duo, 2.0 GHz (minimum)
- 2 GB DDR3 RAM (minimum)
- 8 GB Hard Drive space available
- 1024x768 screen resolution (minimum)
- USB 2.0
- Wireless 802.11b/g/n Ethernet card
- 100BASE-T Ethernet Adapter

Macintosh, Quicktime and Safari are registered trademarks of Apple Inc. Windows Media and Internet Explorer are registered trademarks of the Microsoft Corporation in the United States and/or other countries. Firefox is a registered trademark of the Mozilla Foundation. Adobe® Flash Player is a trademark of Adobe Systems Inc.

Using Müse

The Müse software is a browser-based application that can communicate directly with the simulator.

With the software, users can run SCEs, create scenarios and SCEs, import and export educational content and perform administrative functions.

NOTE: For optimal Müse performance, no other software programs should be open while Müse is running.

IMPORTANT: Only one Müse application window or tab and one TouchPro window or tab can be used per Instructor Workstation at a time.

IMPORTANT: Do NOT use any of the browser's navigational tools (i.e., back and forward buttons) while operating Müse.

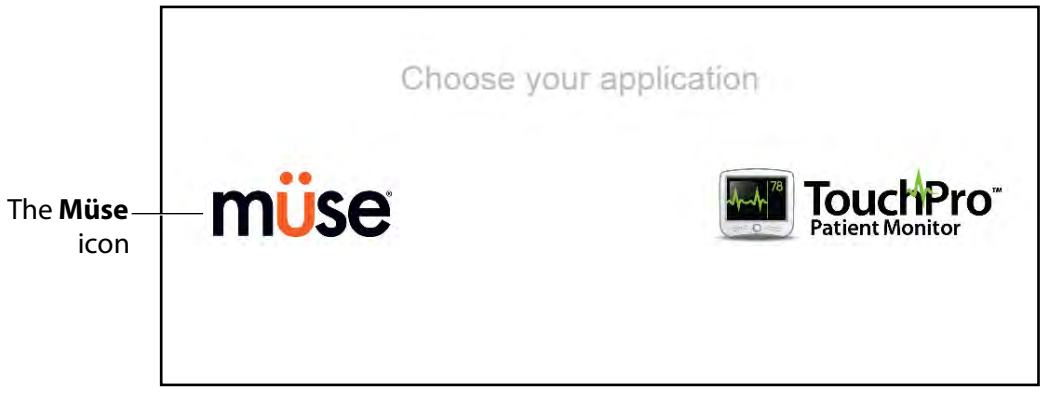
Starting the Application

Once the simulator is powered on and the Instructor Workstation is connected to the simulator network, the Müse software can be launched.

To launch the software:

1. Using the Laptop or Tablet Instructor Workstation, launch the web browser (e.g., Safari, Internet Explorer)

   The Müse Start Screen appears.



The Müse Start Screen

2. Select **Müse**.

   The Login screen appears.

The Müse Login Screen

The links in the bottom left corner of the screen provide access to additional information about the software:

- Click the **About** link to access information about the Müse software version, the type of simulator and the serial number.
- Click the **User Guide** link to download the user guide (English version). To access the User Guide in other languages, please visit www.caehealthcare.com and click the **Support** link.
- Click the **Support** link for CAE Healthcare Support contact information.
- Click the globe-shaped **Language** icon in the bottom left corner to change the language of the Müse software.

3. On the Login screen, enter the **Username** *admin* and the **Password** *admin* in the appropriate fields to access Müse.

The Müse Login Fields

Müse opens to the Home page by default.

Navigating the Home Page

From the Home page, users can run, create, edit, search for and print SCEs.

The Home page can be accessed by clicking the **Home** button in the upper right corner of the Müse software or, on any screen without a **Home** button, by clicking the **Return** button in the upper left or right corner of the screen.

müse
All
Anaphylaxis
Holly Monroe
Angina with Cardiac Arrest
Bruce Stevens
Anterior Myocardial Infarction
Steve Johnson
Asthmatic with Pneumothorax
Jason Riley
COPD Exacerbation with Respiratory Fail...
Paul Conti
COPD Patient
Grandma Smokey
Page 1 / 4
Open Library
New SCE...
Anaphylaxis
Holly Monroe
Print SCE
Add To Favorites
Age 21 years old
Gender Female
Weight 70.0 kg
Base Norma L. Female
Overview
Your rescue squad responds to a report of a 21-year-old female complaining of trouble breathing. She was eating dinner at a cookout when she noticed some tightness in her chest. The cook came by asking if anyone wanted another shrimp burger. She then told him she was allergic to shellfish. She was proceeding to her car to retrieve an epinephrine auto-injector when a wasp stung her.
This SCE consists of six states that manually transition.
During the initial assessment in State 1 Beginning Anaphylaxis, the patient presents with early signs of anaphylaxis, HR in the 90s, BP in the 100s/50s, RR in the 20s and SpO2 in the low 90s on room air. She remains conscious. The learner is expected to assess and manage the patient's airway, breathing and circulatory status (ABCs), identify early signs of allergic reaction, consider use of oxygen, call for help with interventions, consider early use of epinephrine and attach a cardiac monitor. If more than 120 seconds elapses without administration of epinephrine, the instructor should manually advance the SCE to State 2 Mild Anaphylaxis. If epinephrine is administered, the SCE is advanced to State 5 Epinephrine Administered.
In State 2 Mild Anaphylaxis, the patient experiences increased respiratory distress. The patient's HR is in the 110s.
Review
Run
About
User Guide
Support
meti admin

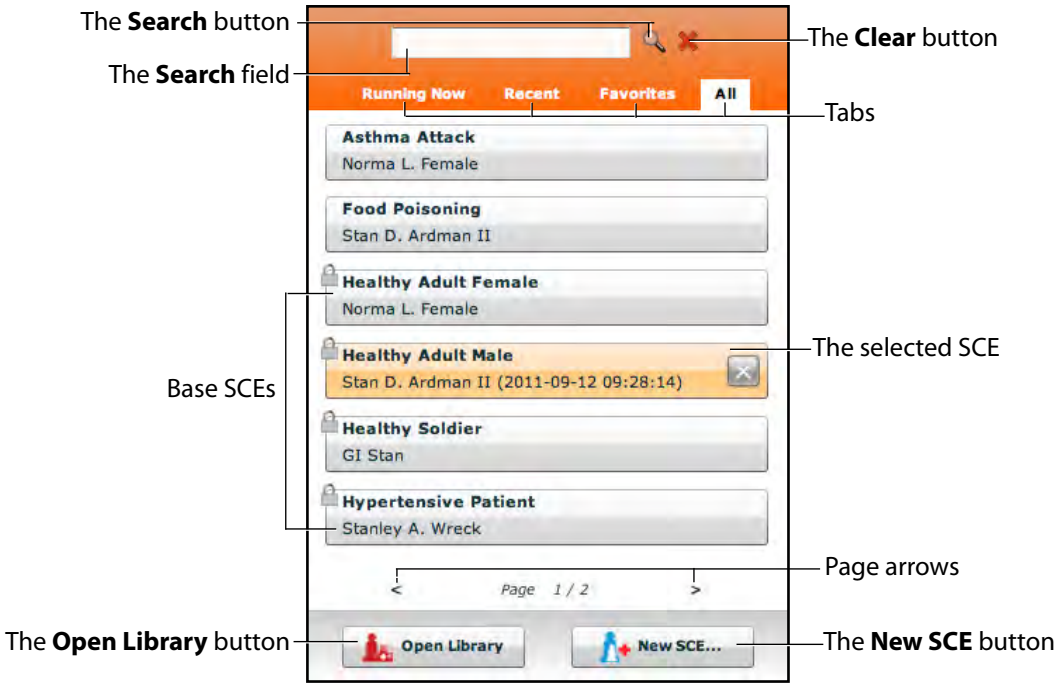
The Home Page

NOTE: To activate a fullscreen view in Internet Explorer, press F11 to toggle Internet Explorer's fullscreen mode.

The SCE Selection Panel

SCEs are process tools that enable the facilitator to execute a learning strategy using simulation. Preconfigured CAE Healthcare SCEs provide an extensive overview and outline of the learning exercise and require minimal additional faculty development time for use. Each SCE is comprised of a patient and up to four scenarios.

Available SCEs appear in the SCE Selection panel on the Home page.



The SCE Selection Panel

The SCE Selection panel has four tabs that access SCEs: Running Now, Recent, Favorites and All.

- **Running Now** tab: Lists the SCEs that are currently running and is only available when at least one SCE is running.
- **Recent** tab: Lists all the recently run or edited SCEs.
- **Favorites** tab: Lists all SCEs that have been selected as favorites and is only displayed after favorites have been selected. To add a favorite SCE to your profile, click the **Add to Favorites** button at the top of any SCE on the Home page. Managing favorites is achieved in the Account Profile portion of the software.
- **All** tab: Lists all SCEs, including user-created SCEs and all SCEs from available learning modules.

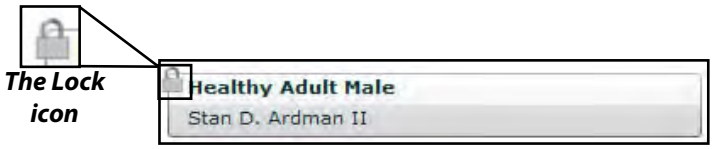
To search for an installed SCE, enter part of the name of an SCE in the **Search** field and click the **Search** button.

Click any SCE to select it. Once an SCE is selected, it appears in the SCE Summary panel.

To run an SCE, click **Run** in the SCE Summary panel to execute the SCE. A running SCE appears in orange with an X icon.

Base SCEs are created by CAE Healthcare and represent base patient physiology. Base SCEs have no associated scenarios and no physiological progressions.

The **Lock** icon indicates a locked SCE.



A Locked SCE

Locked SCEs are installed by CAE Healthcare and cannot be deleted. Base and preconfigured SCEs are locked.

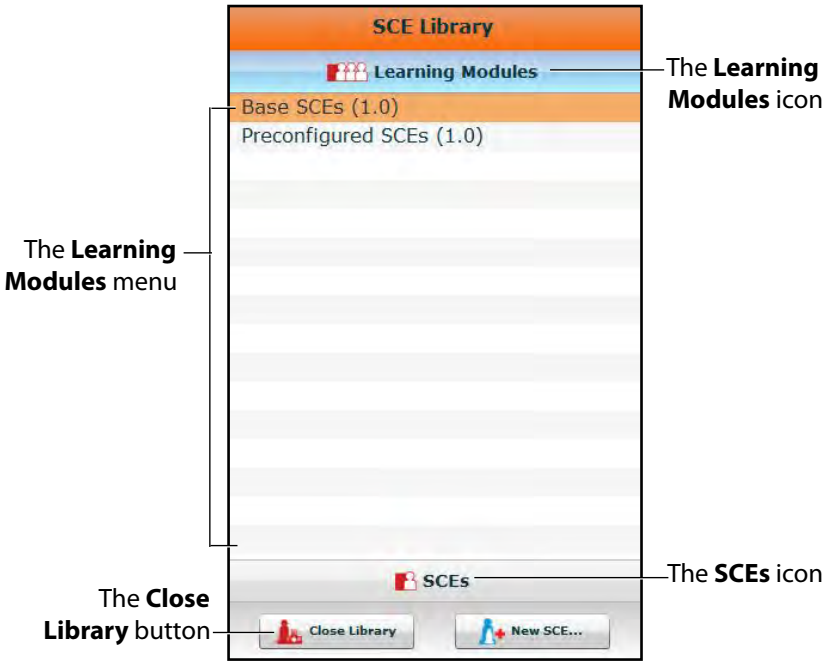
Click the page arrows to view additional pages of installed SCEs.

To open the SCE Library, click the **Open Library** button.

To create a new SCE, click the **New SCE** button.

The SCE Library

Access SCEs from your library by clicking the **Open Library** button at the bottom of the SCE Selection panel. The SCE Library appears.



The SCE Library

The Learning Modules menu is open by default. The Learning Modules menu lists Base SCEs, Preconfigured SCEs and all installed learning applications. Click the desired learning application name to access its SCEs, or click Base SCEs or Preconfigured SCEs. The selected SCEs appear.

Clicking the **SCEs** icon reveals the SCEs menu, which lists all user-created SCEs.

Clicking the **Learning Modules** icon again reveals the Learning Modules menu.

To open an SCE, click the name of the SCE.

Click **Close Library** to exit the SCE Library.

Base SCEs

Base SCEs are fundamental SCEs with no scenarios and no progression of events. Each base SCE is designed to provide facilitators with a baseline to run simulations "on the fly" or as a physiological baseline from which to design their own SCEs.

To access a base SCE from the SCE Library, choose **Learning Modules**, then click **Base SCEs**. The base SCEs are displayed and available for selection.

There are six base SCEs included with HPS with Müse:

Healthy Adult Male
Healthy Adult Female
Healthy Soldier
Hypertensive Patient
Chronic Obstructive Pulmonary Disease (COPD) Patient
Pregnant Female

Preconfigured SCEs

Preconfigured SCEs are training tools with scenarios and multiple states. They are intended to be used for learner education and training.

There are five categories of preconfigured SCEs: Anesthesia, Obstetric, Allied Health, Advanced Cardiac Life Support (ACLS) and Advanced Life Support (ALS).

To access a preconfigured SCE from the SCE Library, choose **Learning Modules**, then click the name of the SCE category. The SCEs in the chosen category are displayed and available for selection.

HPS with Müse includes the following preconfigured SCEs :

Anesthesia

Aortic Cross Clamping
Anaphylaxis in Awake Patient
Cannot Intubate, Cannot Ventilate
Cardiac Tamponade
Emergence Apnea
Emergence Hypertension
Emergence with Laryngospasm
Emergence with Negative Pressure Pulmonary Edema
Total Spinal Anesthesia

Local Anesthetic Toxicity During IV Epidural Injection

Sympathectomy due to Epidural Anesthesia

Hypoxia due to Bronchospasm During Induction of Anesthesia

Hypoxia due to Atelectasis in the Obese Patient During Laparascopy

Malignant Hyperthermia Under General Anesthesia

Tension Pneumothorax

Peripheral Nerve Block Complications

Anesthesia Machine Failure

Anaphylaxis Under General Anesthesia

Awareness During Caesarean Section

Perioperative Anterior Myocardial Infarction

Obstetric

Amniotic Fluid Embolism

Epidural Analgesia

Pulmonary Aspiration

Supine Hypotension Syndrome

Obstetrics Venous Air Embolism

Pre-Eclampsia

Allied Health

Angina with Cardiac Arrest

Asthmatic with Pneumothorax

Chronic Obstructive Pulmonary Disease (COPD) with Respiratory Failure

Heart Failure with Pulmonary Edema

Inferior Myocardial Infarction

Organophosphate Exposure

Pneumonia with Septic Shock

Severe Young Asthmatic

Splenic Rupture with Pneumothorax

Stab Wound to the Chest

Subdural Hematoma

Anaphylaxis

Anterior Myocardial Infarction

Tension Pneumothorax

Advanced Cardiac Life Support (ACLS)

ACLS Acute Coronary Syndrome

ACLS Acute Stroke

ACLS Asystole

ACLS Bradycardia and Heart Blocks

ACLS Pulseless Electrical Activity

ACLS Pulseless Ventricular Tachycardia and Ventricular Fibrillation

ACLS Respiratory Arrest

ACLS Supraventricular Tachycardia

ACLS Ventricular Fibrillation AED

ACLS Ventricular Tachycardia

Advanced Life Support (ALS)

ALS Acute Coronary Syndrome

ALS Acute Stroke

ALS Asystole

ALS Bradycardia and Heart Blocks

ALS Pulseless Electrical Activity

ALS Pulseless Ventricular Tachycardia and Ventricular Fibrillation

ALS Respiratory Arrest

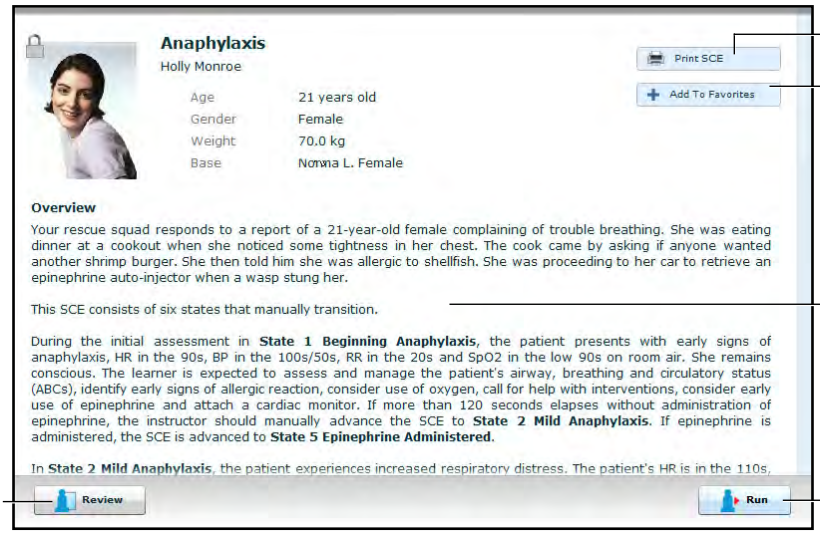
ALS Supraventricular Tachycardia

ALS Ventricular Fibrillation

ALS Ventricular Tachycardia

The SCE Summary Panel

The SCE Summary Panel provides information about the selected SCE.


Anaphylaxis
Holly Monroe
Age 21 years old
Gender Female
Weight 70.0 kg
Base Norma L. Female
Print SCE
Add To Favorites
Overview
Your rescue squad responds to a report of a 21-year-old female complaining of trouble breathing. She was eating dinner at a cookout when she noticed some tightness in her chest. The cook came by asking if anyone wanted another shrimp burger. She then told him she was allergic to shellfish. She was proceeding to her car to retrieve an epinephrine auto-injector when a wasp stung her.
This SCE consists of six states that manually transition.
During the initial assessment in State 1 Beginning Anaphylaxis, the patient presents with early signs of anaphylaxis, HR in the 90s, BP in the 100s/50s, RR in the 20s and SpO2 in the low 90s on room air. She remains conscious. The learner is expected to assess and manage the patient's airway, breathing and circulatory status (ABCs), identify early signs of allergic reaction, consider use of oxygen, call for help with interventions, consider early use of epinephrine and attach a cardiac monitor. If more than 120 seconds elapses without administration of epinephrine, the instructor should manually advance the SCE to State 2 Mild Anaphylaxis. If epinephrine is administered, the SCE is advanced to State 5 Epinephrine Administered.
In State 2 Mild Anaphylaxis, the patient experiences increased respiratory distress. The patient's HR is in the 110s,
Review
Run
The Print button
The Add to Favorites button
The SCE Content Summary
The Review button
The Run button

The SCE Summary Panel

The **Print SCE** button can be used to generate a printable PDF of the selected SCE.

The **Add to Favorites** button adds the SCE to your Favorites list.

Clicking the **Review** button accesses the SCE Editor, which can be used to review and edit SCEs.

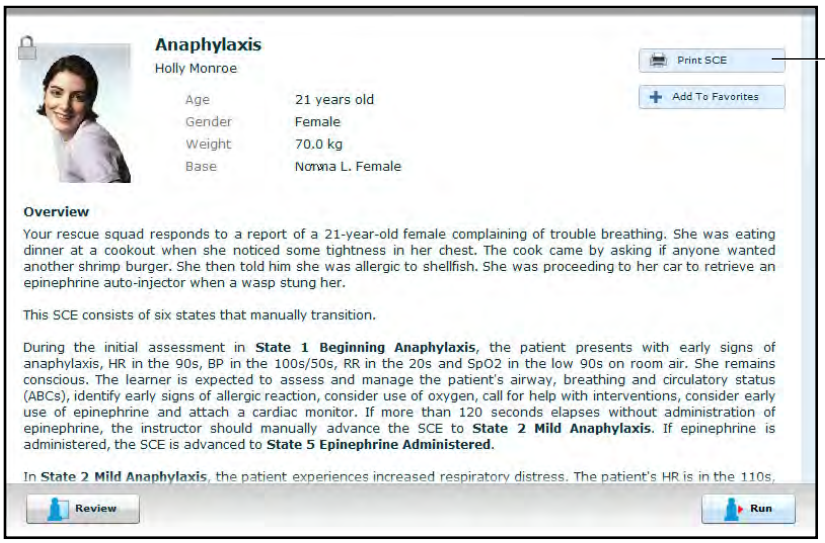
Select the **Run** button to run the SCE.

Printing SCEs

To print an SCE:

1. From the Home page, select the SCE to print.

   The SCE summary panel appears.


Anaphylaxis
Holly Monroe
Print SCE
Add To Favorites
Age 21 years old
Gender Female
Weight 70.0 kg
Base Norma L. Female
Overview
Your rescue squad responds to a report of a 21-year-old female complaining of trouble breathing. She was eating dinner at a cookout when she noticed some tightness in her chest. The cook came by asking if anyone wanted another shrimp burger. She then told him she was allergic to shellfish. She was proceeding to her car to retrieve an epinephrine auto-injector when a wasp stung her.
This SCE consists of six states that manually transition.
During the initial assessment in State 1 Beginning Anaphylaxis, the patient presents with early signs of anaphylaxis, HR in the 90s, BP in the 100s/50s, RR in the 20s and SpO2 in the low 90s on room air. She remains conscious. The learner is expected to assess and manage the patient's airway, breathing and circulatory status (ABCs), identify early signs of allergic reaction, consider use of oxygen, call for help with interventions, consider early use of epinephrine and attach a cardiac monitor. If more than 120 seconds elapses without administration of epinephrine, the instructor should manually advance the SCE to State 2 Mild Anaphylaxis. If epinephrine is administered, the SCE is advanced to State 5 Epinephrine Administered.
In State 2 Mild Anaphylaxis, the patient experiences increased respiratory distress. The patient's HR is in the 110s,
Review
Run
The Print SCE button

The SCE Summary Panel

2. From the SCE summary panel, click the **Print SCE** button.

   A PDF of the selected SCE appears in a new browser window.

3. Save the PDF to an external storage device to print from another computer,

   OR

   To print from the Instructor Workstation, consult your network administrator for assistance connecting to a printer.

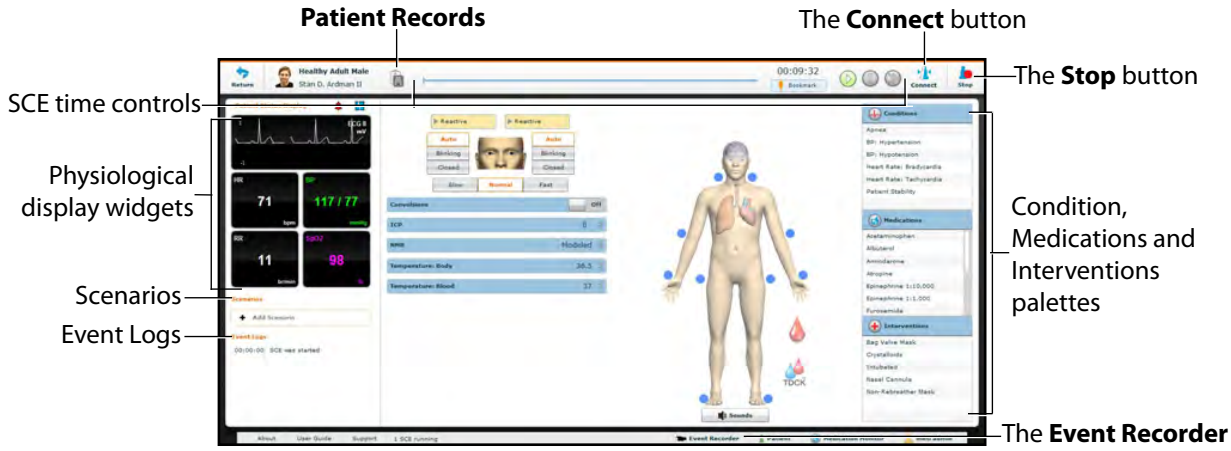
4. When finished saving or printing the PDF, close the browser window containing the PDF to return to Müse.

Running an SCE

To run an SCE, from the Home screen, select an SCE and click the **Run** button. The Run screen can also be accessed from the Scenario Designer or SCE Editor by clicking the **Run** button near the top of the screen.

The Run Button

The Run screen appears.



The Run Screen

From the Run screen, users can manage the SCE, perform interventions, view physiological status and events, save events as states, save the Patient and associate records with the Patient.

Connecting to the Simulator

After starting an SCE by clicking the **Run** button, click **Connect** to connect to the simulator. The **Connect** button is located in the upper right corner of the Run screen.

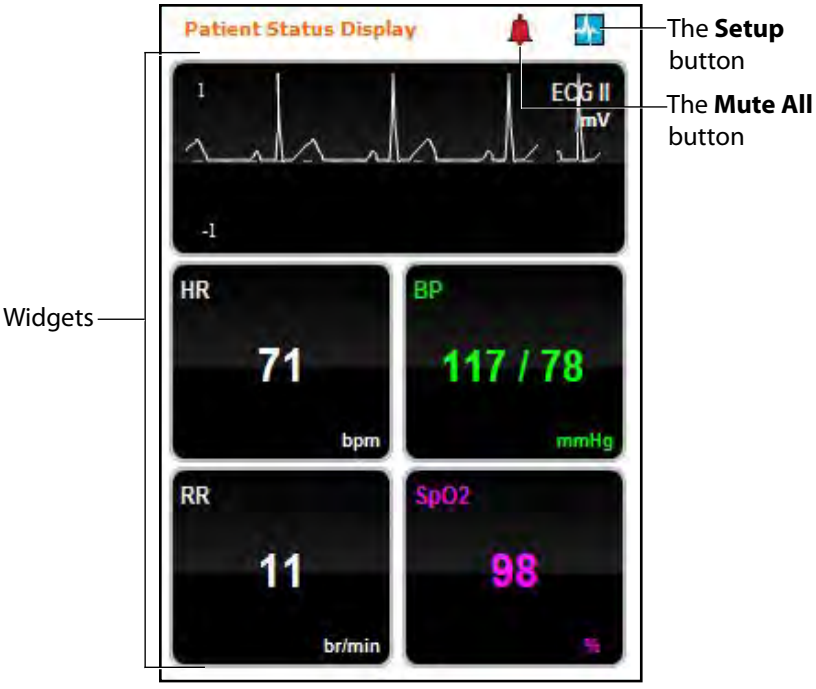
The Connect Button

An SCE must be running before you can connect to the simulator.

IMPORTANT: When a connection to another HPS from the same Instructor Workstation is desired, you must disconnect from the HPS and restart the Instructor Workstation prior to connecting to the second HPS.

Using the Patient Status Display

On the Run screen, there are widgets that display the patient's physiological status. The **Patient Status Display** widgets can be changed to reflect the user's needs. There are six available display spaces for the widgets. Waveform widgets utilize two display spaces.

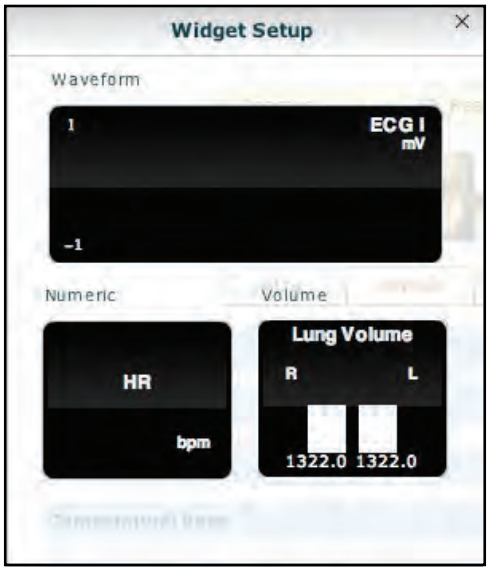


The Patient Status Display Widgets

Use the **Mute All** button to mute all Patient Status Display alarms.

To adjust the widget layout, click the **Setup** button.

The Widget Setup menu opens, displaying available widget types: Waveform, Numeric and Volume.



The Widget Setup Menu

Adjust the Patient Status Display layout by dragging a widget type from the Widget Setup Menu and dropping it over the Patient Status Display. The new widget type replaces the old.

To change a **Patient Status Display** widget, click the widget to be changed. A list of available parameters appears.

NOTE: The capnogram waveform is not displayed on the TouchPro software from the Instructor Workstation. Capnogram information can be found on the clinical patient monitor if one is connected to the simulator.

Choose the desired option from the list and the widget changes to reflect the new selection.

From the numeric widget menu, you can also use the **Set Color** button to change the display color of the widget and the **Set Alarm** button to change the alarm settings for the selected widget.

The Event Logs

During an SCE, all software operations sensed by the simulator or entered manually (e.g., virtual defibrillation) are recorded by an event entry that appears on the screen. The event entry notes what occurred and the time it happened.

The Event Logs

Event Logs can also be exported. For more information, see *History on page 123*.

Displaying Patient Records

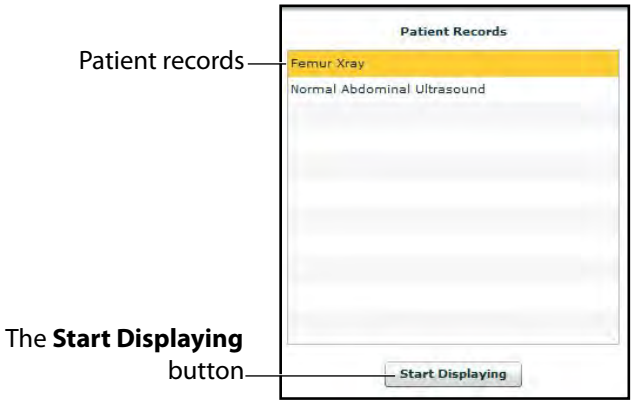
Patient records can be uploaded to Müse and displayed in the TouchPro software while an SCE is running.

To display an uploaded patient record:

1. From the Müse Run screen, click the **Patient Records** button.

The Patient Records Button

The Patient Records list appears, displaying all available patient records.



The Patient Records List

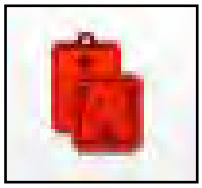
2. Select a patient record from the list.
3. Click **Start Displaying**.

   The patient record is shown in a new TouchPro web browser window.

   IMPORTANT: Ensure pop-up blocking is turned OFF in the web browser of the Instructor Workstation and any TouchPro workstations. Consult the web browser's help menu for assistance.

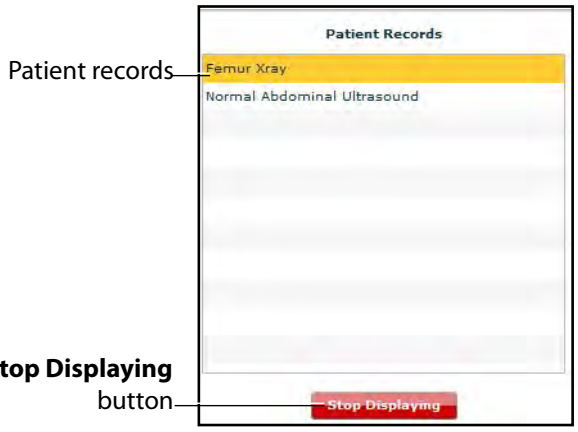
   NOTE: The web browser window containing the patient record may be minimized initially. If the window is not readily visible, click the web browser icon on the Dock (Macintosh Instructor Workstation) or Taskbar (Windows Instructor Workstation) to locate the new window.

   The **Patient Records** button turns red, indicating that a patient record is being displayed.



The Patient Records Button

The **Start Displaying** button at the bottom of the Patient Records list changes to a red **Stop Displaying** button.



The Patient Records List

To stop displaying a patient record, click **Stop Displaying** at the bottom of the Patient Records list.

To close the Patient Records list, click the **Patient Records** button. The list closes. If a patient record is being displayed, the **Patient Record** button remains red until the list is re-opened and **Stop Displaying** is chosen.

NOTE: Only one patient record can be displayed at a time.

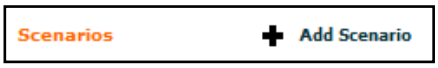
For information about uploading patient records to Müse for selection from the Run screen, see *Patient Records on page 132*.

Adding a Scenario to a Running SCE

SCEs incorporate scenarios that contain pre-programmed physiology. Scenarios can be added to SCEs to enhance patient physiology.

To add a scenario to an SCE that is running:

1. Click the **Add Scenario** button on the Run screen



The Add Scenario Button

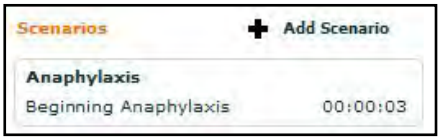
   The Choose Scenario dialog box appears.

2. Select a scenario from the Choose Scenario Dialog Box.

   The **Search** field can be used to search for a scenario to select.

3. Click **Add**.

   The scenario is added to the SCE and appears under the **Scenarios** heading on the Run screen.



An Added Scenario

Changing Physiology

The patient physiology can be adjusted while an SCE is running in two ways: by using one of the physiological views on the Run screen to modify parameters or by using the Conditions, Interventions and Medications palettes.

Using the Physiological Views

From the Run screen, users can select from six different views representative of various body systems and features:

Neurological

Respiratory

Cardiovascular

Fluids

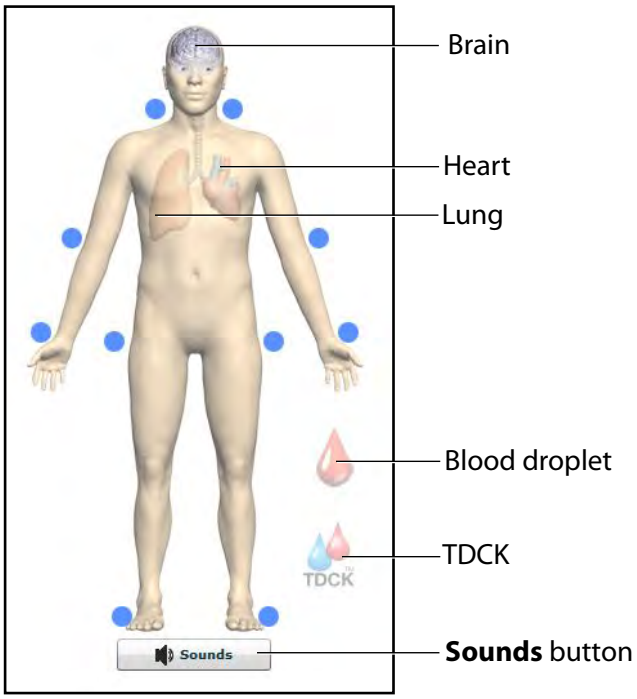
TDCK

Sounds

To access each view, click the appropriate organ, icon or button.

- For Neurological, click the brain.
- For Respiratory, click the lung .
- For Cardiovascular, click the heart.
- For Fluids, click the droplet of blood.
- For TDCK, click the TDCK icon
- For Sounds, click the **Sounds** button.

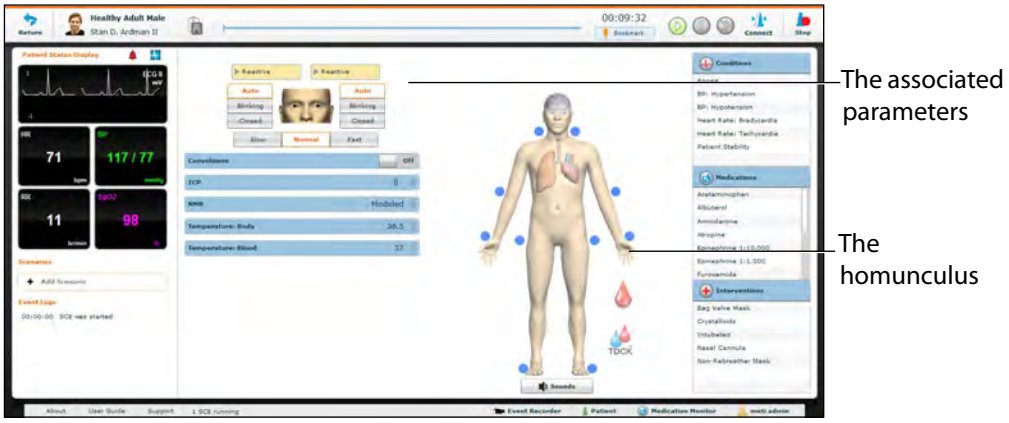
From each view, various parameters can be viewed and adjusted.



The Physiological Views

To change a patient's physiology using the physiological view:

1. Click the appropriate organ, icon or button from the homunculus to select the appropriate physiological view.



The Run Screen

The associated parameters appear to the left of the homunculus.

2. Locate the desired parameter.

   NOTE: Basic parameters are shown by default in the Respiratory and Cardiovascular views. The Basic/Additional switch can be toggled to show more parameters.

3. Select the parameter and set the new value.

   Parameters have varying controls, such as sliders, switches and menus. In the image below, the Heart Rate parameter is shown. Within the Heart Rate parameter, there are switches that toggle between **Modeled** and **Override** and **Seconds** and **Minutes**, a slider that sets the beats per minute and it's an available field where the beats per minute value can be keyed in.

The Heart Rate Parameter

Once the parameter has been set, it is reflected in the patient's physiology.

Types of Parameters

There are two types of parameters: numeric and discrete.

Once a parameter is selected and set, the patient's physiology changes according to the model for that parameter.

Numeric Parameters

Numeric parameters set either a measured value (e.g., 20 mL) or a multiplied value called a factor (e.g., Heart Rate Factor 2.0 is two times the baseline Heart Rate).

Numeric parameters are changed by clicking in the relevant field and entering a new value in place of the existing one or using a slider to move through the range of parameter values until the desired numeric value is established.

Once a measured value is set, that value overrides the physiologically modeled parameter value. To return to a physiologically modeled value, switch the slider in the parameter dialog from **Override** to **Modeled**.

Discrete Parameters

Discrete parameters enable users to select one of two or more options.

Discrete parameters are changed by choosing the appropriate option using a drop-down menu or toggle switch.

In the image below, the Needle Decompression parameter is shown. The Needle Decompression parameter is set using a discrete parameter switch that toggles between **Off** and **On**.

The Needle Decompression Switch

Once the parameter has been set, it is reflected in the patient's physiology.

NOTE: Not all changes to parameters affect the patient's physiology, but all are logged.

Using the Conditions, Medications and Interventions Palettes

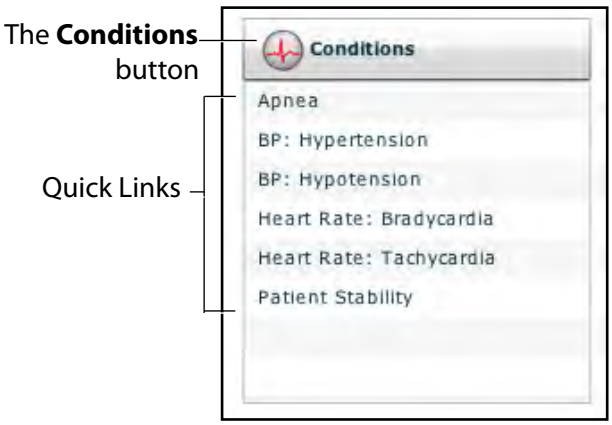
The Conditions, Medications and Interventions palettes on the Run screen enable the application of conditions, medications and interventions during simulation. Once applied, conditions are reflected in the patient's physiology and logged. All medications and interventions are also logged, and most affect the patient's physiology.

Using the Conditions Palette

Conditions are preprogrammed pathophysiological states that use one or more physiological parameters and are designed to enable you to create physiological changes on the fly.

There are two ways to apply conditions using the Conditions palette: using a Quick Link or using the complete Conditions menu. Quick Links are preconfigured conditions that are made accessible in the Conditions palette for quick application. Quick Links can also be created for the **Medications** and **Interventions** palettes.

To set parameters using the Quick Links in the **Conditions** palette, click one of the Quick Links. The condition is applied and affects the patient's physiology.



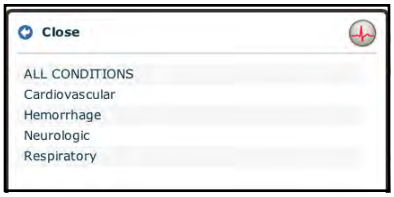
The Conditions Palette

NOTE: Quick Links can only be added while creating or editing an SCE.

Or, to apply a condition that is not set up as a Quick Link in the **Conditions** palette:

1. Click the **Conditions** button.

   The Conditions menu appears. Conditions are organized by system, or all available conditions are listed under **ALL CONDITIONS**.



The Conditions Menu

2. Navigate the menus to find the desired condition.

   Once the desired condition has been located, click the condition's name from the list.

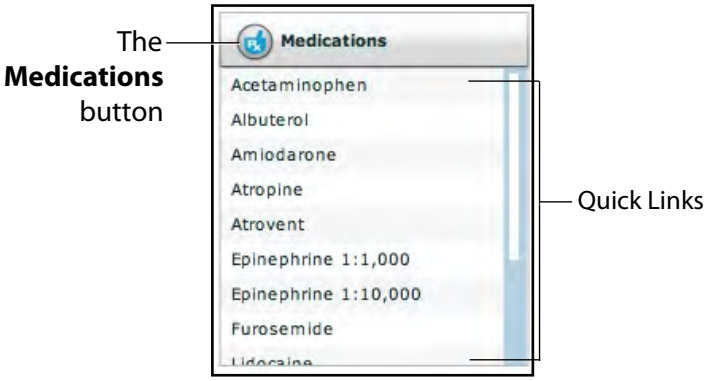
   The condition is applied and affects the patient's physiology.

Using the Medications Palette

There are two ways to administer medications using the **Medications** palette: using a Quick Link or using the **Medications** menu. Quick Links are preconfigured medications that are made accessible in the **Medications** palette for quick application. Quick Links can also be created for the **Conditions** and **Interventions** palettes.

To set parameters using the Quick Links in the **Medications** palette, click a Quick Link. The medication is applied and appears in the patient's physiology.

NOTE: Not all medications affect the patient's physiology, but all are logged.



The Medications Palette

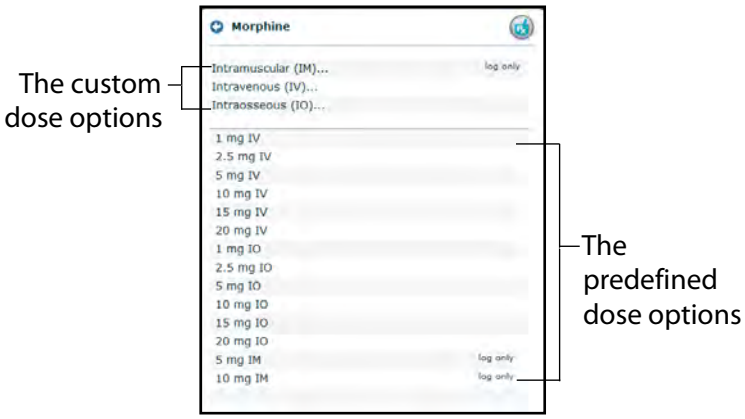
NOTE: Quick Links can only be added while creating or editing an SCE.

Or, to apply a medication that is not set up as a Quick Link in the **Medications** palette:

1. Click the **Medications** button. Medications are organized by type, and all available medications are listed under **ALL MEDICATIONS**.
2. Navigate through the menus to locate the desired medication.
3. Once the medication has been located, click the medication's name from the list.

The All Medications Menu

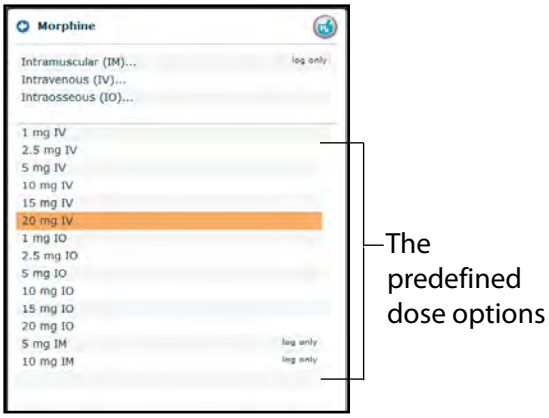
The Medication Dose menu appears, displaying the pre-defined does and custom does routes for the chosen medication.



The Medication Dose Menu

4. Select a dose option. This can be done one of two ways:

    a. Choose a pre-defined dose.

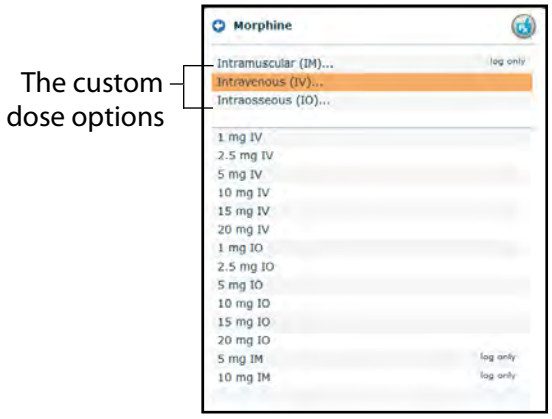


The Medication Dose Menu

The dose is applied and appears in the patient's physiology.

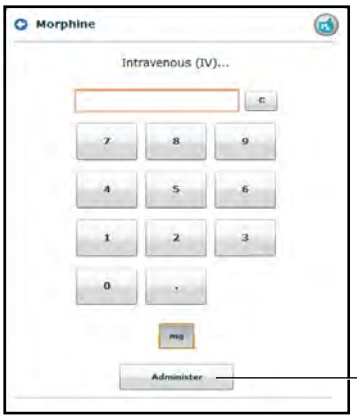
OR,

b. Choose a route of administration to administer a custom dose.



The Medication Dose Menu

The Custom Dose Administration menu appears.



The Custom Dose Administration Menu

5. Enter the desired dose and click the **Administer** button.

   The dose is applied and appears in the patient's physiology.

   NOTE: Not all medications affect the patient's physiology, but all are logged.

Using the Interventions Palette

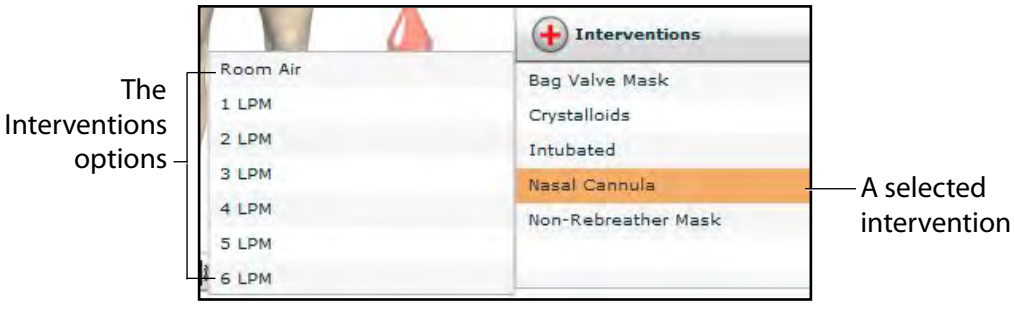
There are two ways to perform and/or administer interventions using the Interventions palette: using a Quick Link or using the complete **Interventions** menu. Quick Links are preconfigured interventions that are made accessible in the **Interventions** palette for quick application. Quick Links can also be created for the **Conditions** and **Medications** palettes.

To apply an intervention using the Quick Links in the **Intervention** palette, click an Intervention Quick Link.

NOTE: Not all interventions affect the patient's physiology, but all are logged.

The Interventions Palette

Once an Intervention is selected, a menu appears with available options for the selected Intervention. Click the desired option to select it. The intervention is applied and appears in the patient's physiology.



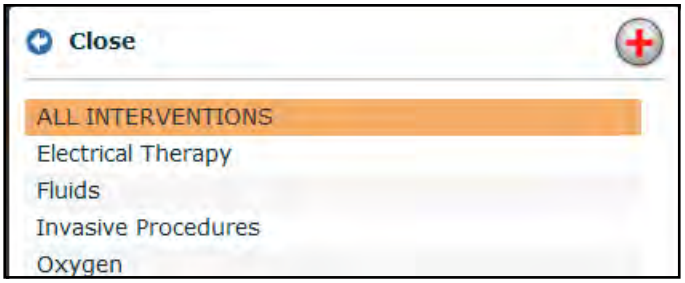
The Selected Intervention Options

NOTE: Quick Links can only be added while creating or editing the SCE.

Or, to apply an intervention that is not set up as a Quick Link in the **Interventions** palette:

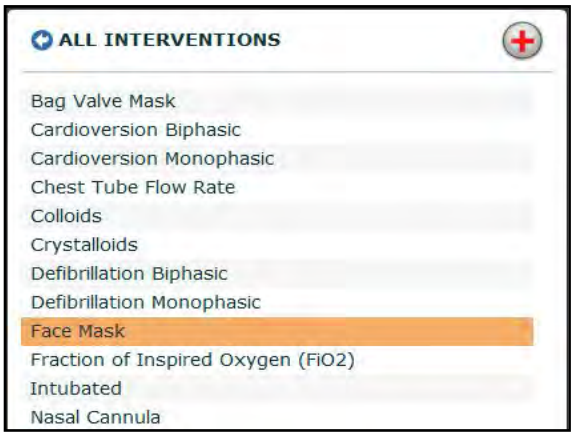
1. Click the **Interventions** button.

   The Interventions menu appears. Interventions are organized by type, or all available interventions are listed under **ALL INTERVENTIONS**.



The All Interventions Menu

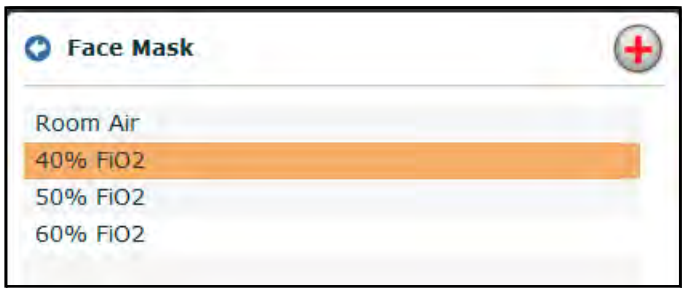
2. Navigate through the menus to find the desired intervention.
3. Once the desired intervention has been located, click the intervention's name from the list.



The All Interventions Menu

   The Intervention Options menu appears, showing the available options for the selected intervention.

4. Click the desired option.



The Intervention Options

The intervention is applied and appears in the patient's physiology.

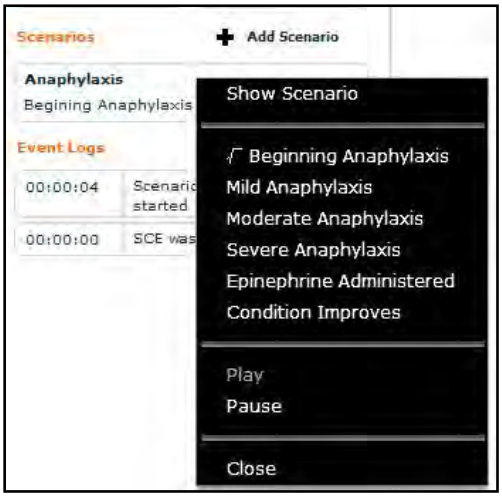
Transitioning Scenario States from the Run Screen

To move between scenario states from the Run screen:

1. Click the desired scenario.

A Scenario

The Scenario Management pop-up menu appears, and all available states are listed.



The Scenario Management Pop-Up Menu

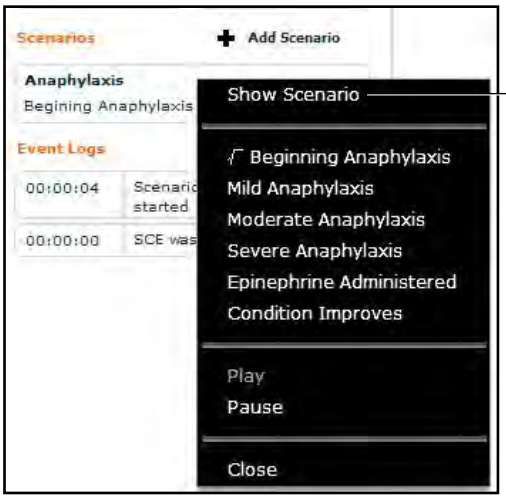
2. Select the desired state. The scenario proceeds to the selected state.

   The scenario can also be paused or continued by selecting the **Pause** and **Play** options from the Scenario Management Pop-Up menu.

Transitioning Scenario States from the Scenario Screen

To move between scenario states from the Scenario Screen:

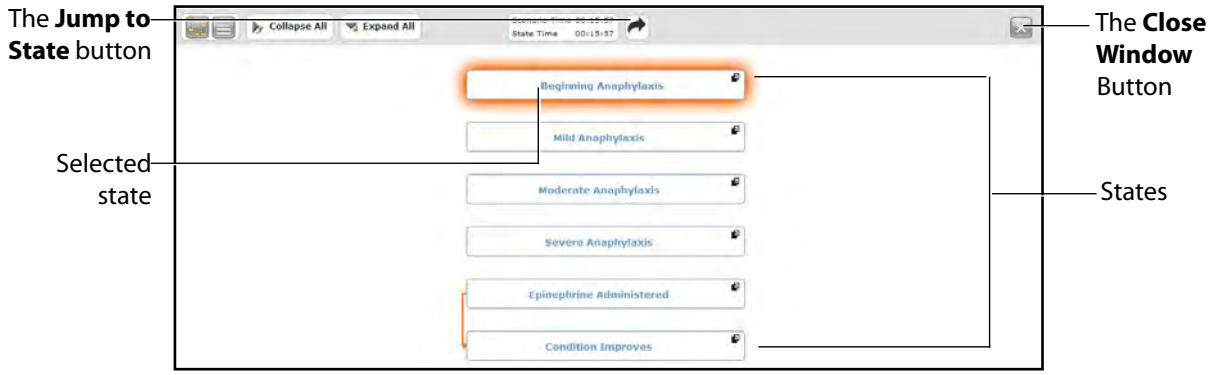
1. From the Run screen, click the desired loaded scenario. The Scenario Management pop-up menu appears.



The Scenario Management Pop-Up Menu

2. From the menu, select **Show Scenario**.

   The Scenario screen appears, displaying the scenario.

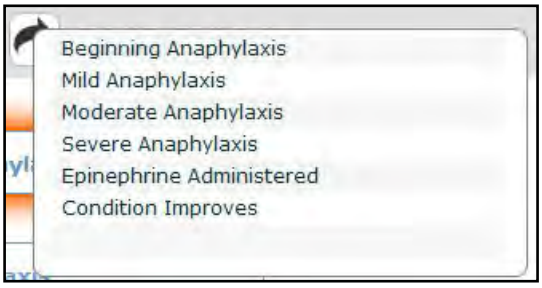


The Scenario Screen

At the top of this screen, the Scenario Time and State Time are visible. Additionally, users can pause and continue playing the scenario by clicking the **Pause** and **Play** buttons on the Scenario Management pop-up menu, which is still visible on the left side of the screen.

3. Click the **Jump to State** button.

   The Jump to State menu appears, displaying the available states.



The Jump to State Menu

4. Select the desired state.

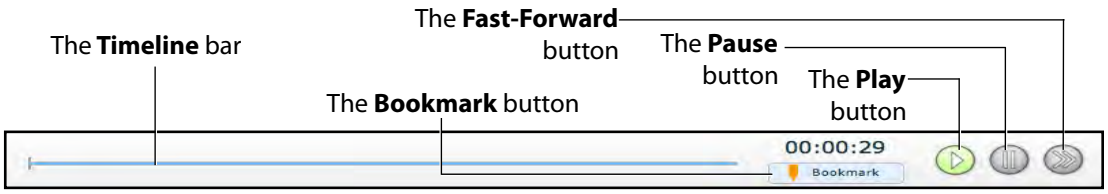
   The scenario transitions to the selected state and the state is highlighted on the Scenario screen.

   NOTE: Double-click on the states to expand to the full view.

5. Click the **Close Window** button to return to the Run screen.

SCE Time Controls

The SCE time controls are located at the top of the Run screen.



The SCE Time Controls

The **Timeline** bar shows the amount of time that has elapsed and bookmarks that have been created.

The **Bookmark** button creates a bookmark at the current point in the SCE. The bookmark can be used later to return to this point in the SCE, resetting the patient's physiology to what it was when the bookmark was created.

The **Play** button starts the SCE if it has been paused.

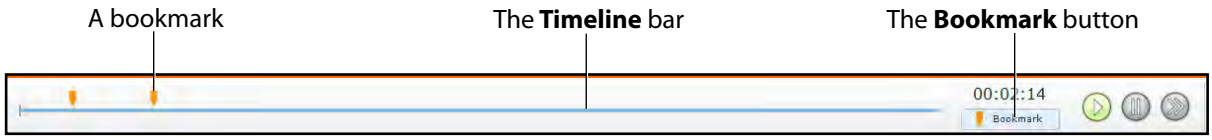
The **Pause** button pauses the SCE time.

The **Fast-Forward** button accelerates the SCE time at a 4:1 ratio.

WARNING: Using the **Pause** or **Fast-Forward** buttons or clicking on a bookmark to return to a previous SCE time causes the simulator to disconnect from Müse.

Using Bookmarks

To create a bookmark, click the **Bookmark** button. An orange bookmark appears on the **Timeline** bar.

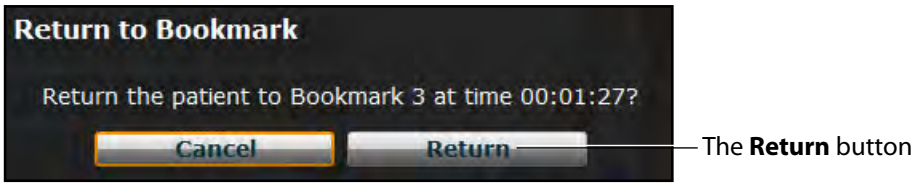


The SCE Time Controls

To return to a bookmarked time in the SCE:

1. Click the orange bookmark on the timeline.

   The Return to Bookmark message appears.



The Return to Bookmark Message

2. Click **Return**.

   The SCE returns the selected point in the timeline.

   NOTE: The SCE time continues moving forward and does not reset to the bookmarked time.

Using the Event Recorder to Save States

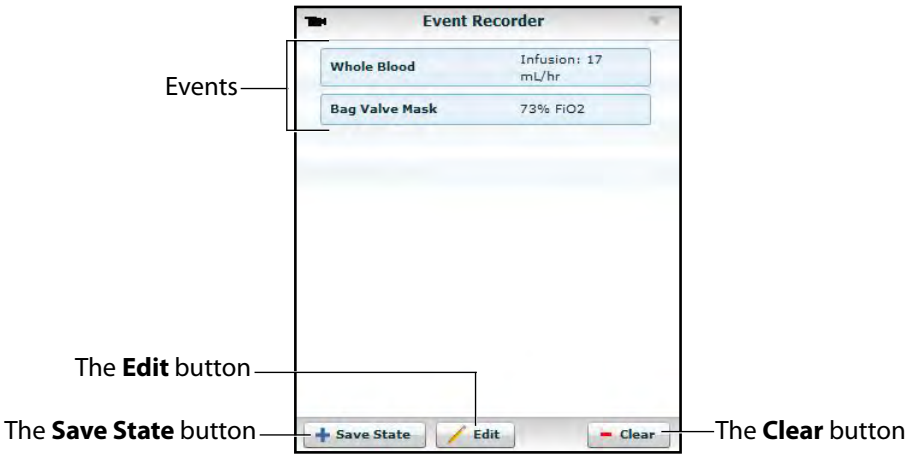
The Event Recorder can be used to save conditions, interventions and parameter changes as states.

To save a state using the Event Recorder:

1. Apply the desired conditions, interventions and parameters.
2. Click the **Event Recorder** button at the bottom of the Müse screen.

The Event Recorder Button

The Event Recorder appears, displaying all events that have occurred since the start of the SCE.



The Event Recorder

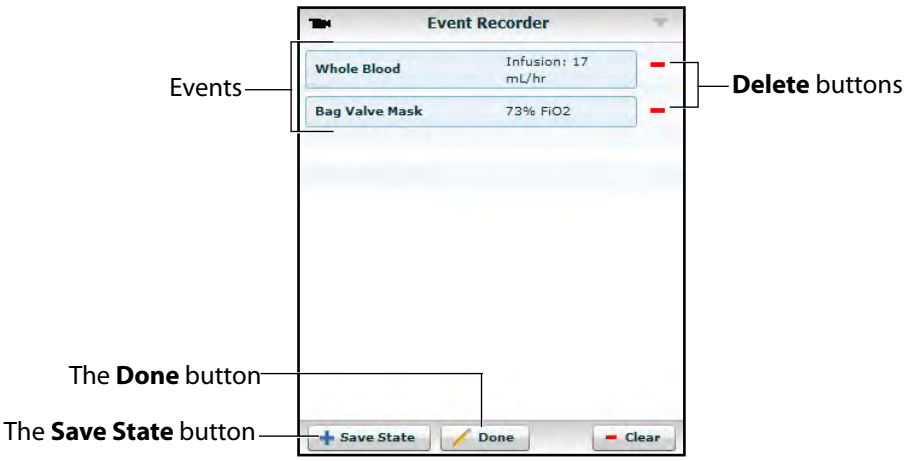
WARNING: The **Clear** button deletes all recorded events. This action cannot be undone.

3. Review the list of events.

   If you wish to remove any events from the state to be saved:

   a. Click **Edit**.

      A **Delete** button appears next to each recorded event.



The Event Recorder

   b. Click the **Delete** button next to each event to be removed.

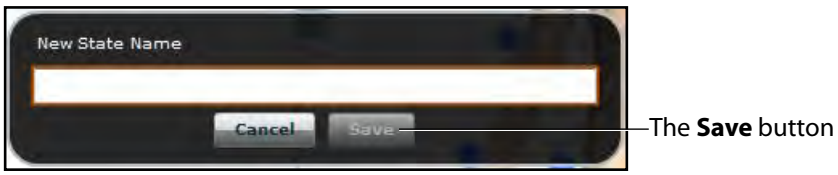
      The events are removed from the Event Recorder.

   c. Click **Done**.

      The **Delete** buttons are hidden.

4. Click **Save State**.

   The New State Name window appears.



The New State Name Window

5. Enter a state name.
6. Click **Save**.

The state is saved to the State Library and can be accessed via the Scenario Designer.

For more information about the State Library, see *Saving States to the State Library on page 118*.

Creating a New Patient

When an additional patient with specific physiological characteristics is needed for repeated use, a new patient can be created from the Run screen.

To create a new Patient:

1. From the Home page, run an SCE that has a Patient with the same gender as the Patient to be created.
2. From the Run screen, apply the desired conditions and set the necessary parameters.
3. Once complete, click the **Patient** button at the bottom of the Run screen.

The Patient Button

The Patient pop-up menu appears.

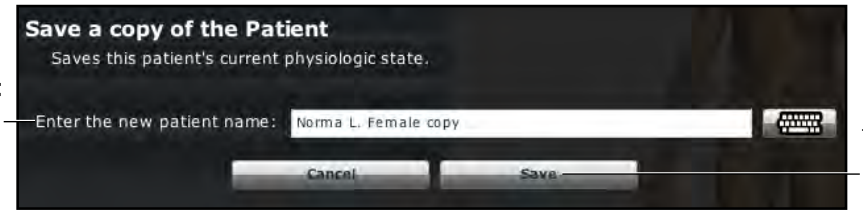
The **Save** button

The Patient Pop-Up Menu

4. Click **Save**.

   The Save a copy of the Patient dialog box appears.

The **Enter the new patient name** field



The **Save** button

The Save a Copy of the Patient Dialog Box

5. Enter a name for the new Patient in the **Enter the new patient name** field.
6. Click **Save**.

   The new Patient is saved and available for selection from the Base Patients Library when creating a new SCE.

Resetting a Patient

Resetting a Patient brings the Patient back to its original physiological state before any scenarios were applied or modifications were made. Any running scenarios are paused. However, the SCE time is unaffected. Additionally, the reset appears in the Event Logs.

NOTE: If baseline physiology settings have been selected, they are removed when the Patient is reset.

To reset a Patient:

1. While running an SCE, click **Patient** at the bottom of the Run screen.

The Patient Button

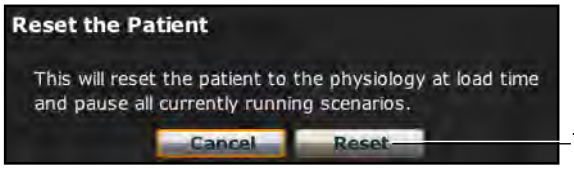
The Patient pop-up menu appears.

The **Reset** button

The Patient Pop-Up Menu

2. Click **Reset**.

The Reset the Patient dialog box appears, stating that the patient's physiology will be reset to its state at load time and all running scenarios will be paused.


Reset the Patient
This will reset the patient to the physiology at load time and pause all currently running scenarios.
Cancel
Reset

The **Reset** button

The Reset the Patient Dialog Box

3. Click **Reset**. The Patient returns to its original physiological state at the start of the SCE.
4. To resume any paused scenarios, click the loaded scenario on the left side of the screen.

   The Scenario Management pop-up menu appears.
5. From the Scenario Management pop-up menu, select **Play**.

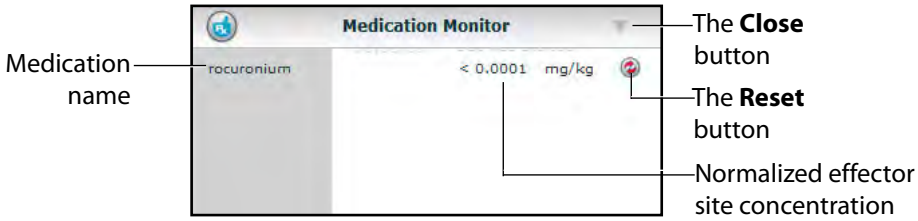
   The scenario is resumed.

The Medication Monitor

The Medication Monitor tracks the infusion of medication administered. To activate the Medication Monitor, from the Run screen, click the **Medication Monitor** button in the bottom, right portion of the screen.

The Medication Monitor Button

The Medication Monitor appears as a movable box on the Run screen.



The Medication Monitor

The normalized effector site concentration is shown next to each medication listing.

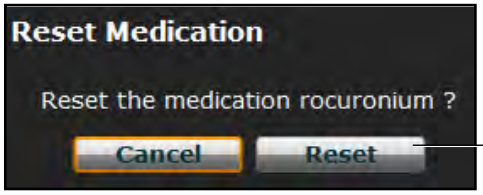
The **Reset** button is used to clear a medication from the physiological model and the Medication Monitor.

To close the Medication Monitor, press the **Close** button in the upper right corner of the medication Monitor window.

Resetting a Medication

To reset a medication from the Medication Monitor, click the **Reset** button on the Medication Monitor.

The Reset Medication dialog box appears, asking you to confirm that you wish to reset the medication.



The Reset Medication Dialog Box

The medication is cleared from the model and from the Medication Monitor.

With continuous infusions, the amount infused goes back to zero, but the infusion continues. To stop the infusion, you must select the medication from the medication library and set the infusion rate to zero.

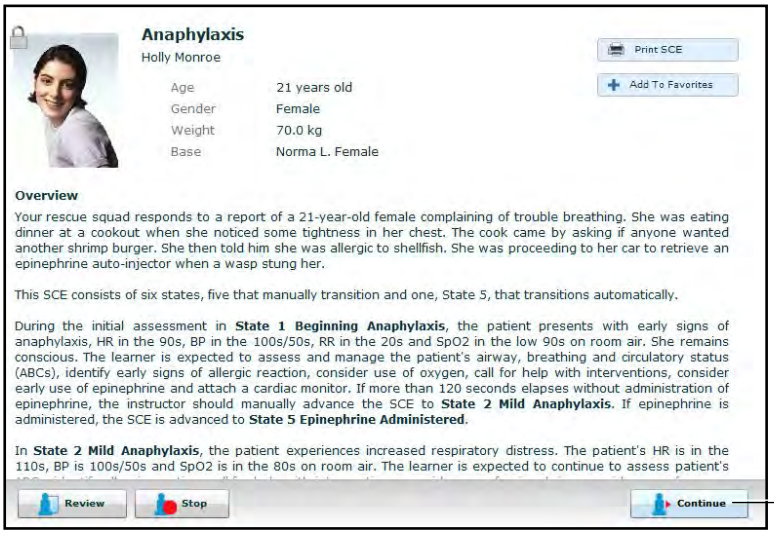
Returning to the Home Page

To exit the SCE and return to the Home page, click the **Return** button.

The Return Button

The SCE continues running and the Home page appears.

To return to the SCE from the Home page, click the **Continue** button in the SCE summary panel of the running SCE.


Anaphylaxis
Holly Monroe
Print SCE
Add To Favorites
Age 21 years old
Gender Female
Weight 70.0 kg
Base Norma L. Female
Overview
Your rescue squad responds to a report of a 21-year-old female complaining of trouble breathing. She was eating dinner at a cookout when she noticed some tightness in her chest. The cook came by asking if anyone wanted another shrimp burger. She then told him she was allergic to shellfish. She was proceeding to her car to retrieve an epinephrine auto-injector when a wasp stung her.
This SCE consists of six states, five that manually transition and one, State 5, that transitions automatically.
During the initial assessment in State 1 Beginning Anaphylaxis, the patient presents with early signs of anaphylaxis, HR in the 90s, BP in the 100s/50s, RR in the 20s and SpO2 in the low 90s on room air. She remains conscious. The learner is expected to assess and manage the patient's airway, breathing and circulatory status (ABCs), identify early signs of allergic reaction, consider use of oxygen, call for help with interventions, consider early use of epinephrine and attach a cardiac monitor. If more than 120 seconds elapses without administration of epinephrine, the instructor should manually advance the SCE to State 2 Mild Anaphylaxis. If epinephrine is administered, the SCE is advanced to State 5 Epinephrine Administered.
In State 2 Mild Anaphylaxis, the patient experiences increased respiratory distress. The patient's HR is in the 110s, BP is 100s/50s and SpO2 is in the 80s on room air. The learner is expected to continue to assess patient's
Review
Stop
Continue
The Continue button

The SCE Summary Panel

Stopping the SCE

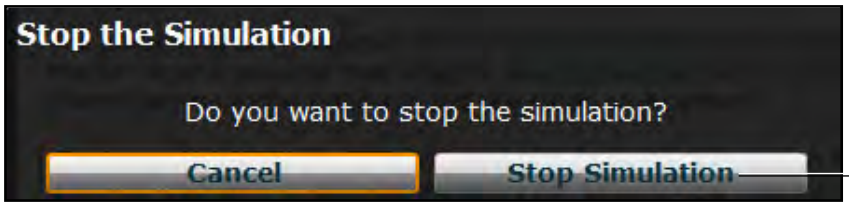
Running SCEs can be stopped from the Run screen or the Home page.

To stop an SCE from the Run screen:

1. Click **Stop** in the upper right corner of the screen.

The Stop Button

The Stop the Simulation dialog box appears.



The Stop The Simulation Dialog Box

2. Click **Stop Simulation**.

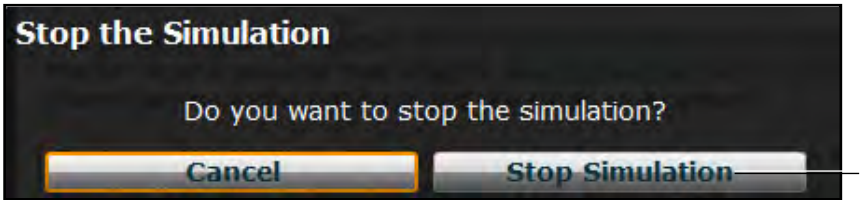
   The SCE stops running and the Müse Home page is shown.

To stop an SCE from the Home page:

1. Click the **Stop** button in the bottom left corner of the SCE Summary Panel.

The Stop Button

   The Stop the Simulation dialog box appears.



The Stop The Simulation Dialog Box

2. Click **Stop Simulation**.

   The SCE stops running.

IMPORTANT: Always stop all running SCEs before logging out of Müse. If you log out of Müse for HPS without stopping SCEs and then launch Müse for PediaSIM, you will not be able to run SCEs. If this happens, relaunch Müse for HPS and stop all running SCEs, then relaunch Müse for PediaSIM to run SCEs. The inverse is also true. If you log out of Müse for PediaSIM without stopping SCEs and then launch Müse for HPS, you will not be able to run SCEs. Relaunch Müse for PediaSIM and stop all running SCEs, then relaunch Müse for HPS to run SCEs.

Developing SCEs

Creating and editing SCEs are similar processes. Once an SCE is created, the steps for modifying the SCE are the same as those for editing a previously-created SCE. The processes of creating and editing SCEs each begin with a unique button on the Home screen.

Use the **New SCE** button to create a new SCE.

The New SCE Button

The minimal requirements for creating a new SCE include selecting a Patient, naming the SCE and saving the SCE. Once the new SCE is created, you can continue with the SCE development or edit it later.

Use the **Review** button to edit an existing SCE.

The Review Button

Creating a New SCE

Creating an SCE requires naming the SCE and selecting a Base Patient.

To create a new SCE:

1. From the Home screen, click **New SCE**.

The New SCE Button

The Patients Palette appears.

The Patients Palette

2. Select a patient from the palette and click **Create**.

   The SCE Editor appears, showing the Enter a name for the SCE dialog box.

The SCE Editor Screen

3. Enter the name for the SCE.

   NOTE: The name of the SCE may NOT exceed 80 characters. Additionally, SCE file names CANNOT contain any special characters, such as / \ : * ? < > % | “

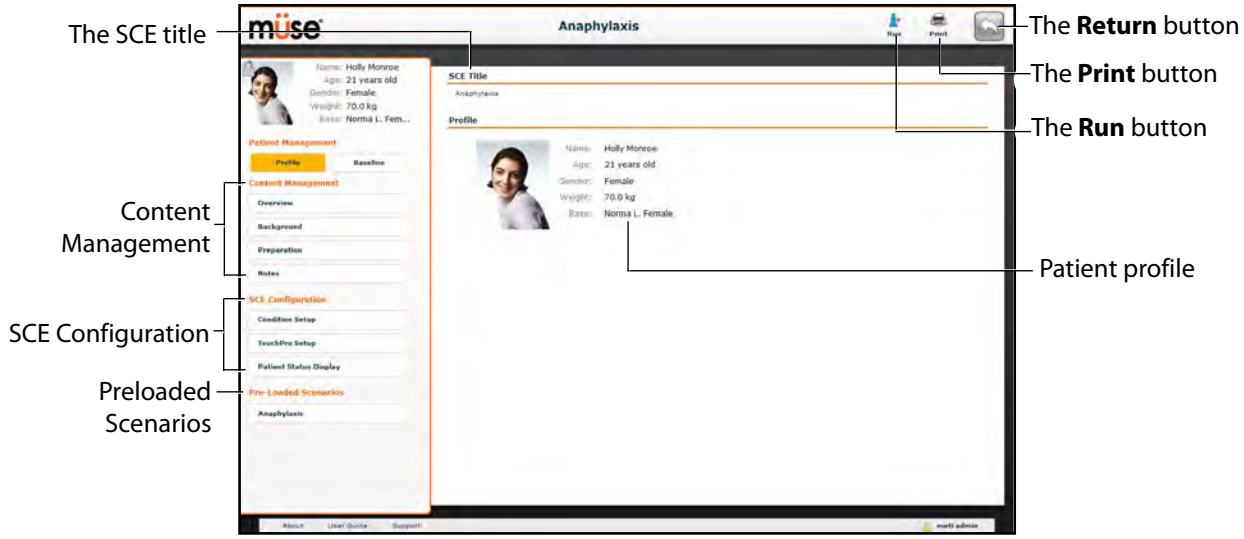
4. Click **Save**.

   Once the SCE is saved, it is stored and can be edited and reviewed at any time, including creating a Patient Profile and content, determining settings and programming scenarios.

The SCE Editor

The SCE Editor can be used to review preconfigured SCEs and to create or edit custom SCEs.

To access the SCE Editor, click the **Review** button in the SCE Summary Panel or create a new SCE.



The SCE Editor

The buttons in the upper right corner of the SCE Editor provide options for running the SCE, generating a printable PDF of the SCE or returning to the Home page.

The **Content Management**, **SCE Configuration** and **Preloaded Scenario** links in the left panel are used to review the SCE content and configuration and to view scenarios applied to the SCE.

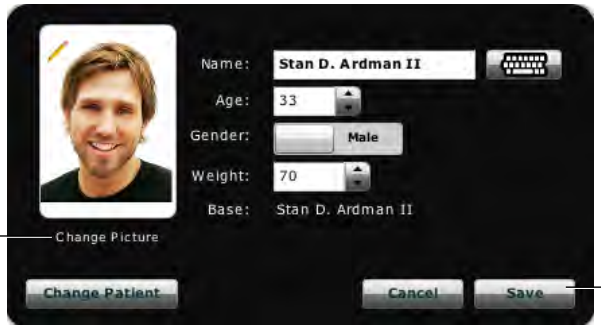
Editing a Patient's Profile

To edit the Patient Profile:

1. From the SCE Editor, in the **Profile** section, click **Edit**.

The SCE Editor Screen

The Profile Editor appears.



The Profile Editor

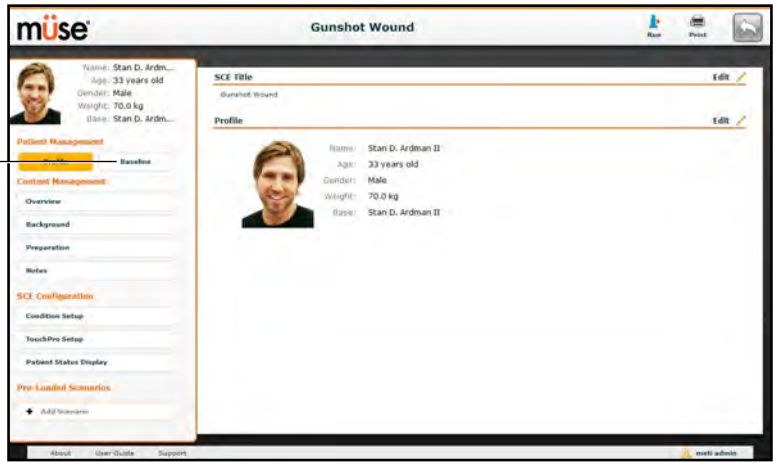
2. Set the Patient's name, age, gender and weight by filling in the appropriate fields.
3. Click the **Change Picture** button to change the patient's picture (optional).
4. Click **Save**.

   IMPORTANT: No part of the patient's profile can contain any special characters, such as / \ : * ? < > % | "

Setting a Patient's Baseline

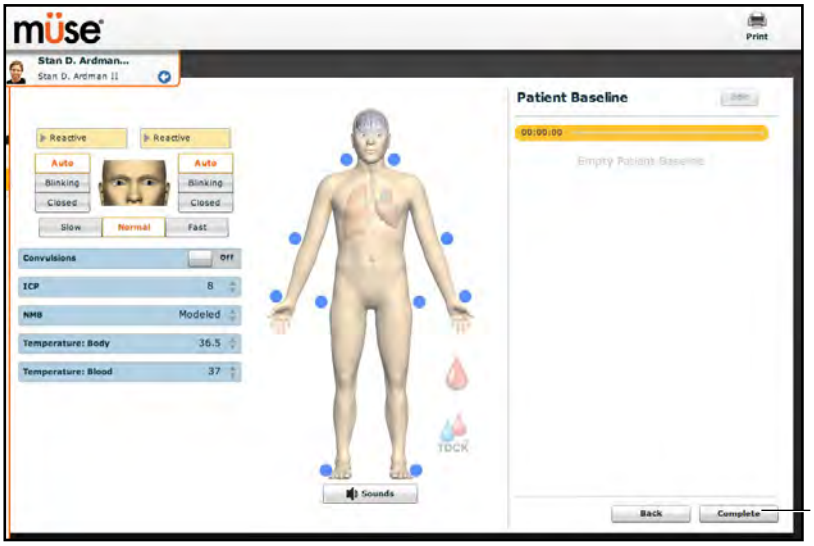
To set the Patient's Baseline:

1. From the SCE Editor, click **Baseline**.



The SCE Editor Screen

The Patient Baseline screen appears.



The Patient Baseline Screen

2. Set the Patient's baseline physiology by modifying the desired parameters.
3. Click **Complete**.

   When the SCE begins, the Patient presents with the selected baseline settings.

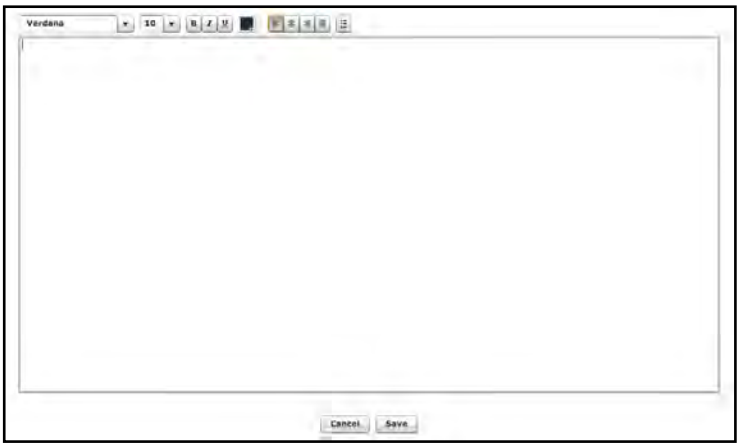
Content Management

SCE Content is entered from the SCE Editor using the **Overview**, **Background**, **Preparation** and **Notes** buttons under the **Content Management** heading.

The Content Management Buttons

Each button accesses a screen that allows users to enter information for the chosen section (Overview, Background, Preparation or Notes). Click the **Edit** button of each section on the SCE Editor to access a rich-text editor that enables data entry.

IMPORTANT: Text can be copied and pasted into the fields from TextEdit or Notepad only.



The Rich-Text Editor

Click **Save** when all data for the field has been entered.

SCE Configuration

Setting up the Conditions, the TouchPro software and the Patient Status Display is achieved by clicking the buttons under the **SCE Configuration** heading in the SCE Editor.

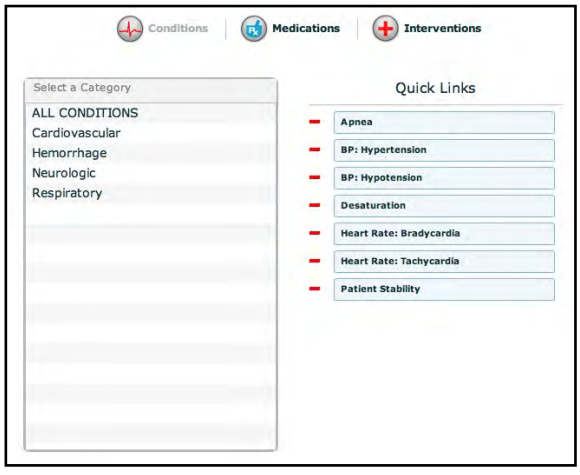
The SCE Configuration Buttons

Condition Setup Screen and Creating Quick Links

Click **Condition Setup** to access the Condition Setup screen. From the Condition Setup screen, conditions, medications and interventions can be preconfigured for the SCE creating Quick Links.

On the Condition Setup screen, **Conditions**, **Medications** and **Interventions** buttons are available. To navigate through available conditions and interventions, click the **Conditions, Medications** and **Interventions** buttons.

The Conditions Setup screen appears.



The Condition Setup Screen

To create a Quick Link, drag and drop the desired choice(s) from the Conditions, Medications or Interventions palette to the list of Quick Links.

Click the minus sign to remove a Quick Link from the SCE.

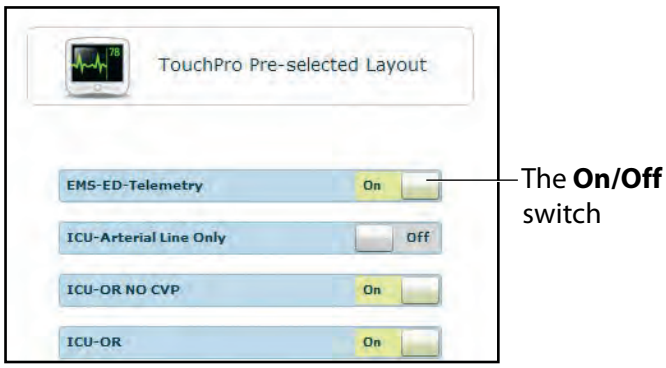
Modifying the TouchPro Setup

Use the **TouchPro Setup** link to access the TouchPro Setup panel.

From the TouchPro Setup panel, TouchPro layouts can be enabled or disabled for the selected SCE.

When a layout is enabled, it is available to be used in the TouchPro software with the selected SCE. When a layout is disabled, it is unavailable to be used in the TouchPro software with this SCE.

Click the **On/Off** switch next to a layout to enable or disable it.



The TouchPro Setup Panel

Patient Status Display

To configure the Patient Status Display displayed on the Run screen, click **Patient Status Display** under the SCE Configuration heading on the SCE Editor.

The Patient Status Display screen appears.

The Patient Status Display Screen

To modify the Patient Status Display, drag and drop the desired waveform, numeric or volume widgets from the Available Widgets panel to an available Patient Status Display space.

NOTE: Waveforms occupy two spaces.

Once the desired widget is placed, click the widget to change the physiologic parameter displayed.

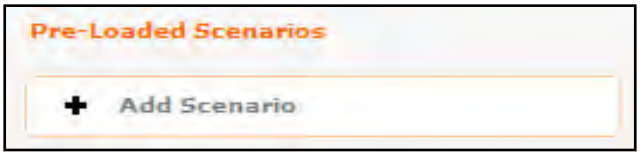
Adding a Scenario from the SCE Editor

SCEs incorporate scenarios that contain preprogrammed physiology. Scenarios can be added to SCEs to enhance patient physiology. When a scenario is added to an SCE from the SCE Editor, the scenario becomes associated with the SCE and begins automatically when the SCE is run.

Click the **Add Scenario** button on the Run screen to add a scenario to an SCE that is running.

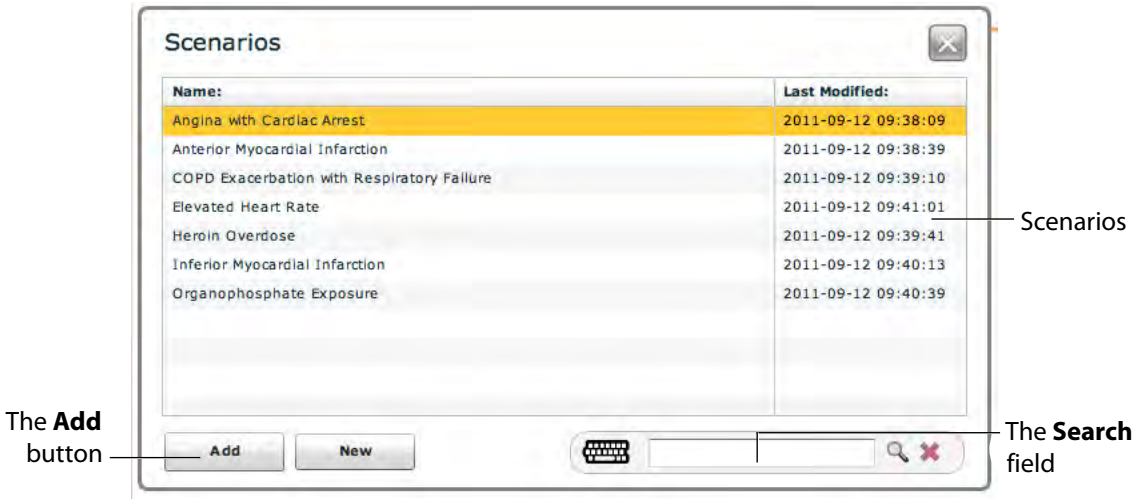
To add a scenario to an SCE from the SCE Editor:

1. Click the **Add Scenario** button under the Preloaded Scenarios heading.



The Add Scenario Button

The Choose Scenario dialog box appears.



The Choose Scenario Dialog Box

2. Select a saved scenario from the Choose Scenario Dialog Box.

   The **Search** field can be used to search for a scenario to select.

3. Click **Add**.

   The scenario is added to the SCE and is listed on the SCE Editor beneath the Pre-Loaded Scenarios heading.

For information about editing scenarios, see *Editing a Scenario on page 102*.

Developing Scenarios

The Scenario Designer allows users to create and edit scenarios.

To access the Scenario Designer, create a new scenario or choose an existing scenario to edit.

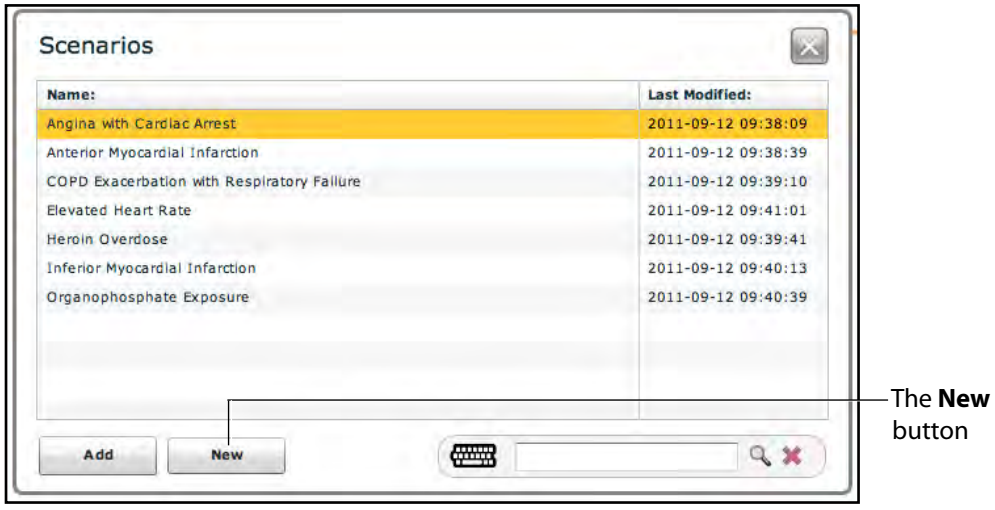
Creating a New Scenario

To create a new scenario:

1. From the SCE Editor, under the Pre-Loaded Scenarios heading, click the **Add Scenario** button.

The Pre-Loaded Scenarios Heading

The Choose Scenario dialog box appears.



The Choose Scenario Dialog Box

2. Click **New**.

   The Scenario Designer appears, displaying the new, untitled scenario.

The Scenario Designer

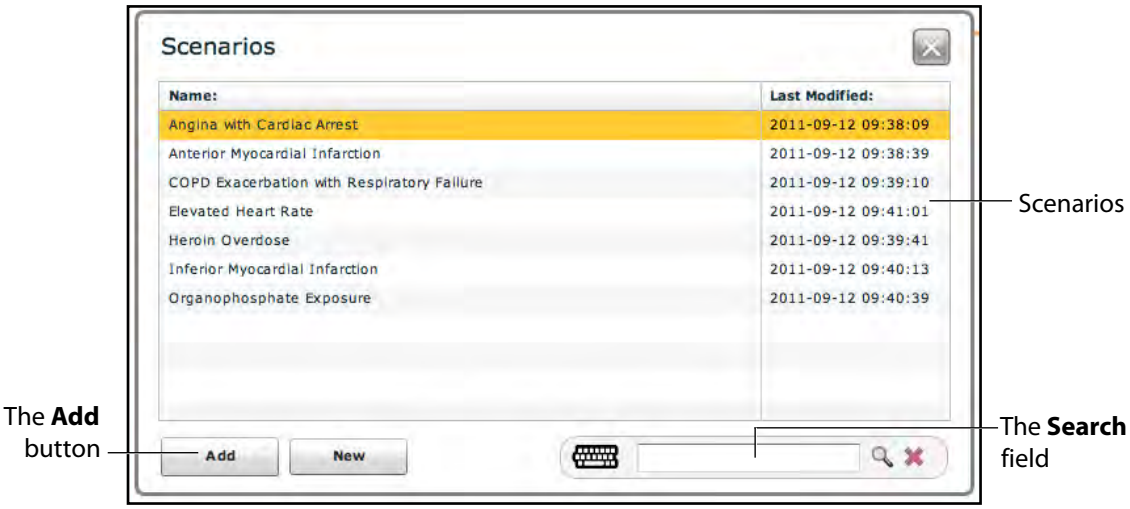
Editing a Scenario

To edit a scenario:

1. From the SCE Editor, under the Pre-Loaded Scenarios heading, click the **Add Scenario** button.

The Pre-Loaded Scenarios Heading

The Choose Scenario dialog box appears.



The Choose Scenario Dialog Box

2. Select a saved scenario from the Choose Scenario Dialog Box.

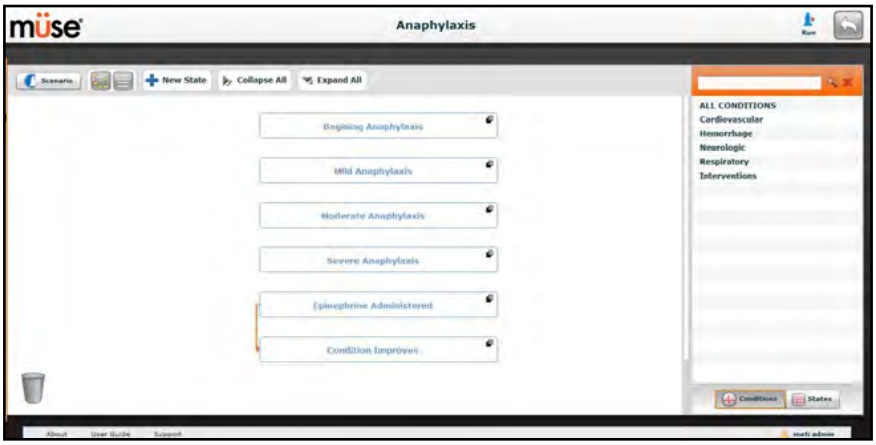
   The **Search** field can be used to search for a scenario to select.

3. Click **Add**.

   The scenario is added to the SCE and is listed on the SCE Editor beneath the Pre-Loaded Scenarios heading.

4. Click the scenario's name under the Pre-Loaded Scenarios heading.

   The Scenario Designer appears, displaying the selected scenario.



The Scenario Designer

The Scenario Designer

The Scenario Designer is accessed by creating or editing a scenario from the SCE Editor.

From the Scenario Designer, scenario states can be added, modified and deleted.

The Scenario Designer

The **Scenario** button is used to manage states and save the scenario.

The **View** buttons toggle between Scenario Designer views.

The **New State** button is used to add new states.

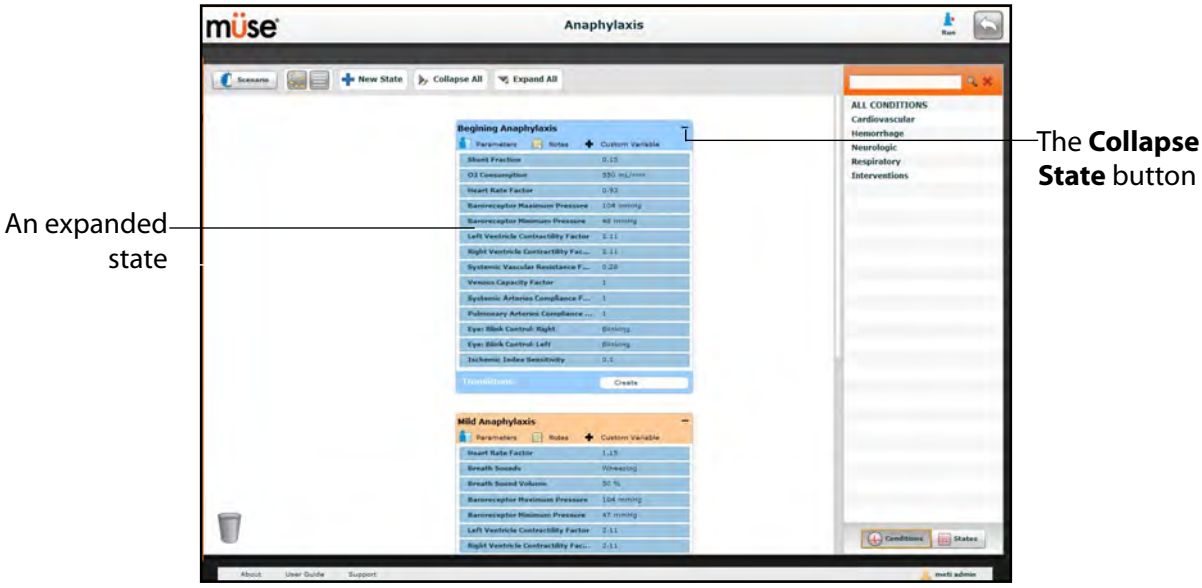
Once created, states are displayed on the Scenario Designer canvas.

Scenario Designer Views

The Scenario Designer has two views: the Graphical view and the Line Item view. The Graphical view allows users to map out scenario states. The Line Item view places the states and transitions into a linear format.

The Scenario Designer View Buttons

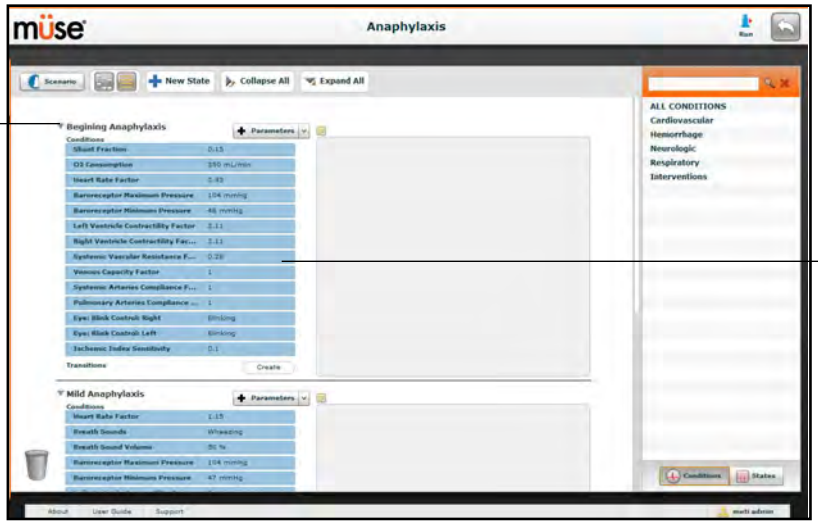
Click the **Graphical view** button to utilize the Graphical View.



The Graphical View

From the Graphical View, double-click on any state to expand it and view all its components. Click the **Collapse State** button to collapse an expanded state.

Click the **Line Item view** button to utilize the Line Item view.

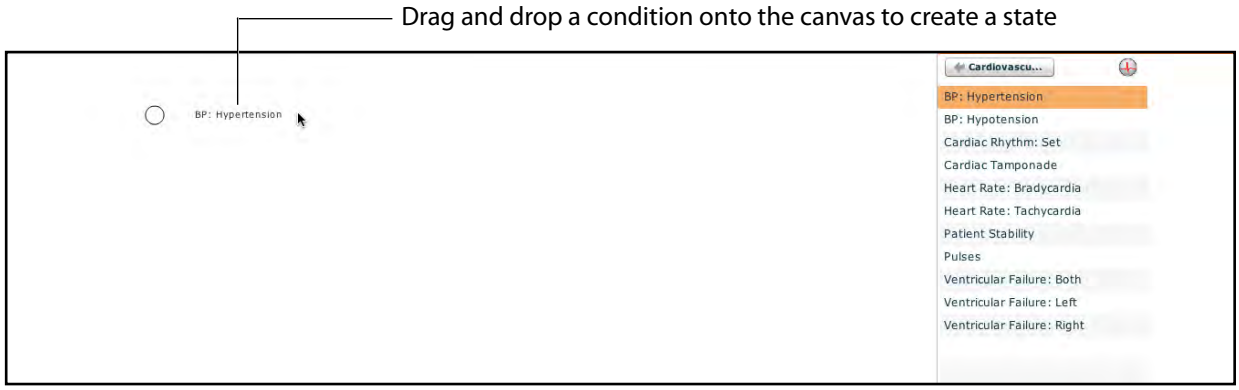


The Line Item View

From the Line Item View, click the **Expand/Contract** arrow to the left of any state to expand it and view all its components. Click the arrow again to collapse the state.

Adding Scenario States

When beginning to create a new scenario, the canvas is blank. Scenario states can be created by dragging and dropping conditions, medications and interventions from their respective menus on the right side of the Scenario Designer to the canvas.



The Scenario Designer Canvas

Or, a new, empty state can be added using the **New State** button.

To add a new state using the **New State** button:

1. Click the **New State** button on the upper left side of the Scenario Designer.

The New State Button

A new state appears.

A New State

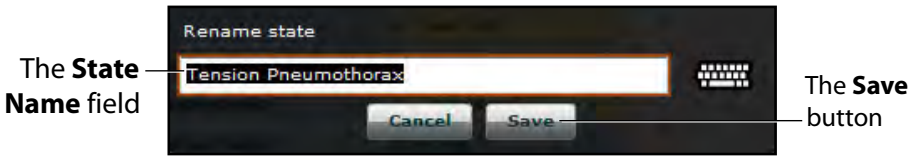
2. From the Graphical View, double-click the new state, or from the Line Item View, click the **Expand/Collapse** arrow to the left of the state to expand it.

   The state expands and additional options appear.

The Expanded State

3. Double-click the state name. (By default, new states are named "State.")

   The Rename state window appears and contains a field for entering a new state name.



The Rename State Window

4. Enter a new state name.

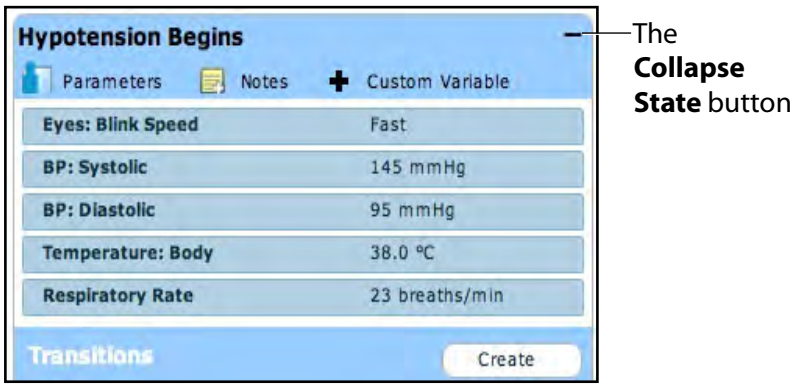
   NOTE: When naming a Scenario State, the state name may NOT exceed 127 characters Additionally, scenario file and state names CANNOT contain any special characters, such as (/ \ : * ? < > % | ")

5. Click **Save**.

   The state is renamed.

Modifying Scenario States

Once a scenario state has been placed on the canvas, it can be modified. Additional parameters, transitions and notes can be added. Each state can contain multiple parameters and transitions. Double-click the state name to rename it.



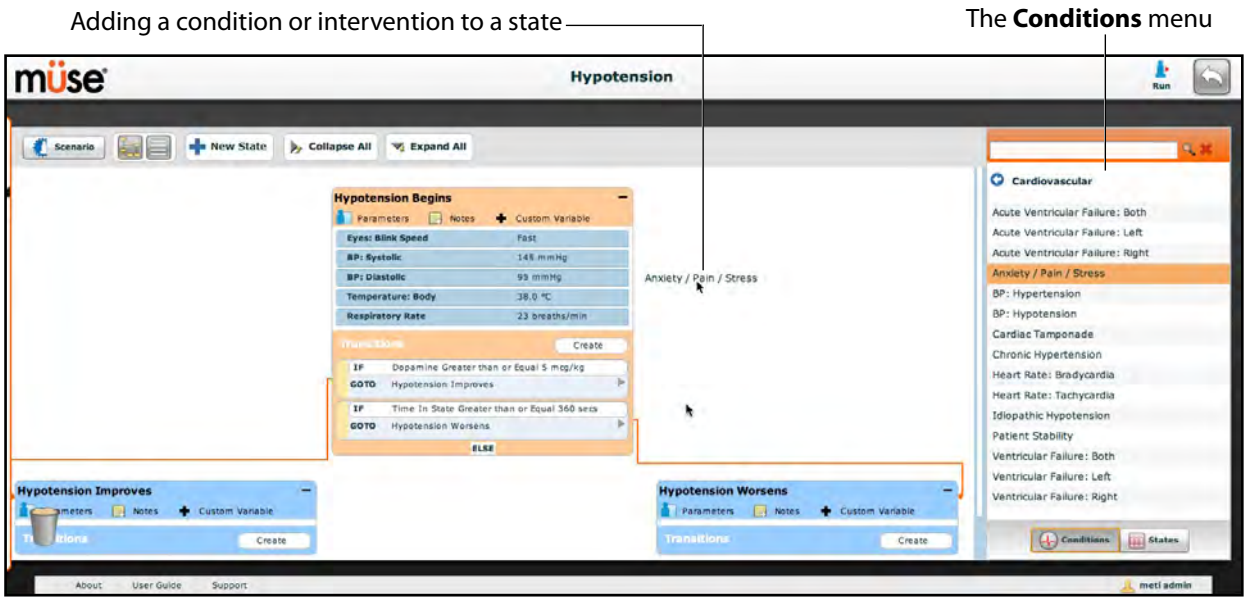
A State

Click the **Collapse State** button to minimize the state.

Double-click the collapsed state to expand it.

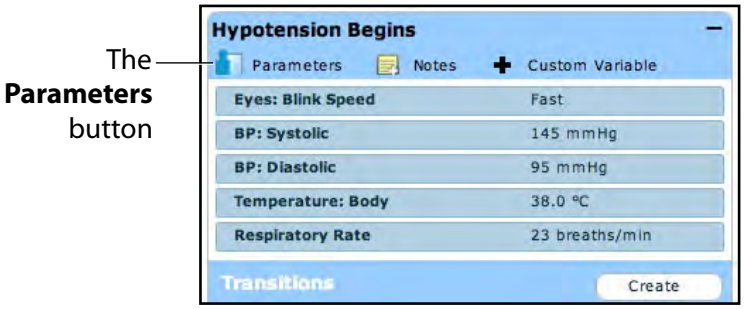
Adding Conditions, Interventions and Parameters

Conditions and interventions can be added to states by dragging and dropping them from the **Conditions** menu to the desired state.



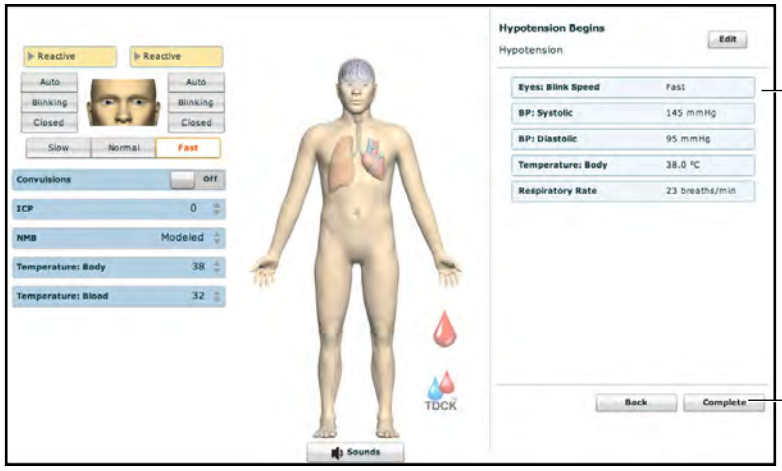
The Scenario Designer

To add parameters to a state, click the **Parameters** button within the state.



A State

The State Parameters screen appears.



The State Parameters Screen

Click the various organs to change the views, and then select the desired parameter. Once a parameter has been selected, it appears in the State Parameters panel on the right side of the screen.

Add as many parameters as needed. Added parameters appear consecutively within the state. Drag and drop to reorder as needed. Click **Complete** to save and exit the State Parameters screen, or click **Back** to exit without saving.

NOTE: If the physiology of any of the parameters conflicts, the Müse software reflects the physiology of the last parameter entered.

Adding Transitions

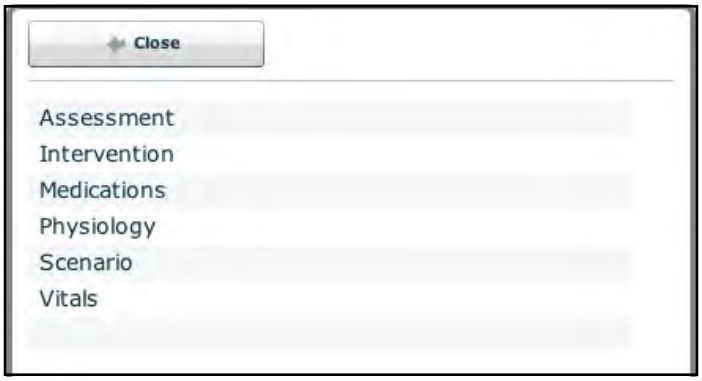
To add a transition, the scenario must have both an original state and a state that results from the transition.

To add a transition:

1. Click the **Create** button in the original state.

A State

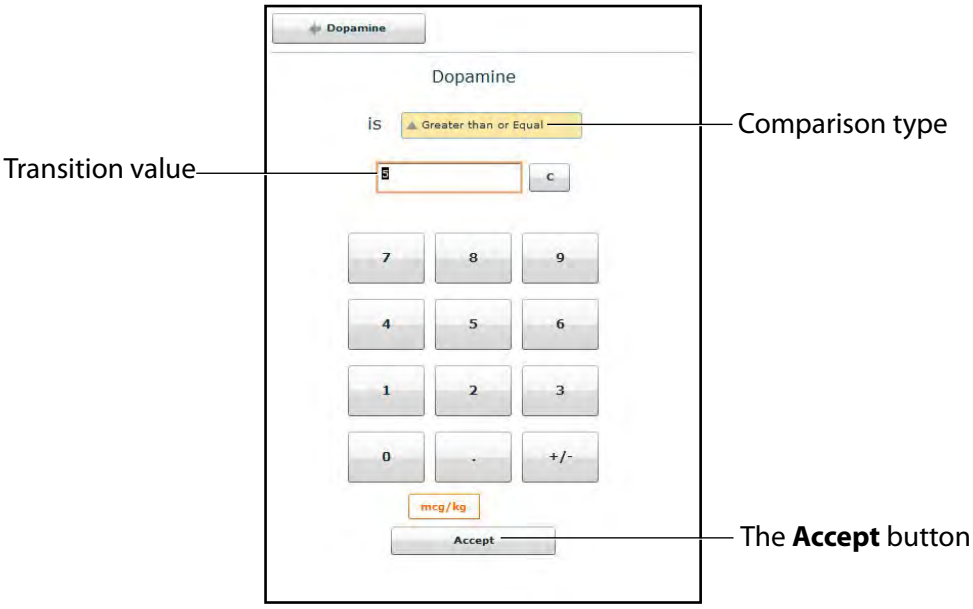
The Transitions Menu appears, listing all available transition variable types.



The Transitions Menu

2. Select the desired variable type. For example, if a transition based on the administration of medication is desired, select **Medications** and then select the desired medication from the list.

Once a medication is selected, The Medication Transition menu appears, asking for the comparison type and transition value.



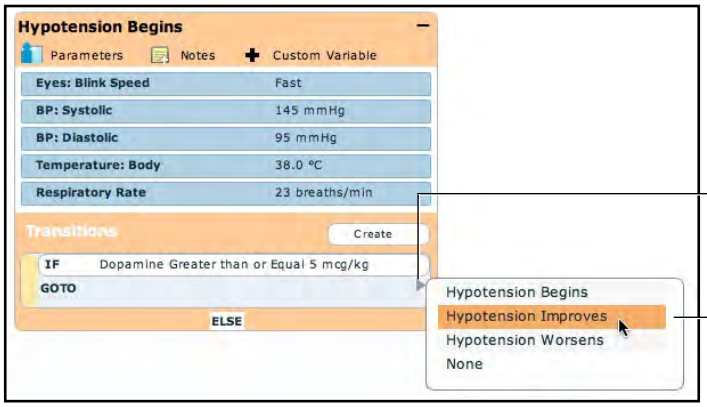
The Medication Transition Menu

Follow the same steps to make selections from similar menus for the **Assessment**, **Intervention**, **Physiology**, **Scenario** and **Vitals** variable types.

3. Once the variable values (e.g., comparison type and transition value) have been selected, click **Accept**.

   The selected transition variable is listed beneath the original state on the Scenario Designer.

4. From the Scenario Designer, click the **GOTO** arrow beneath the new transition variable.

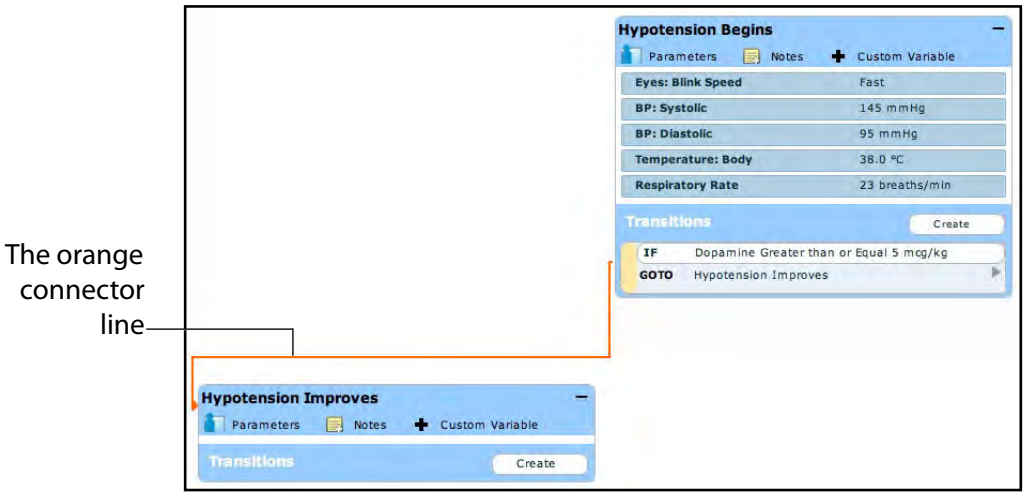


The Scenario Designer

The Available States menu appears, listing all the available states.

5. Select a state from the menu.

An orange connector line appears, indicating that the states are now linked by a transition.



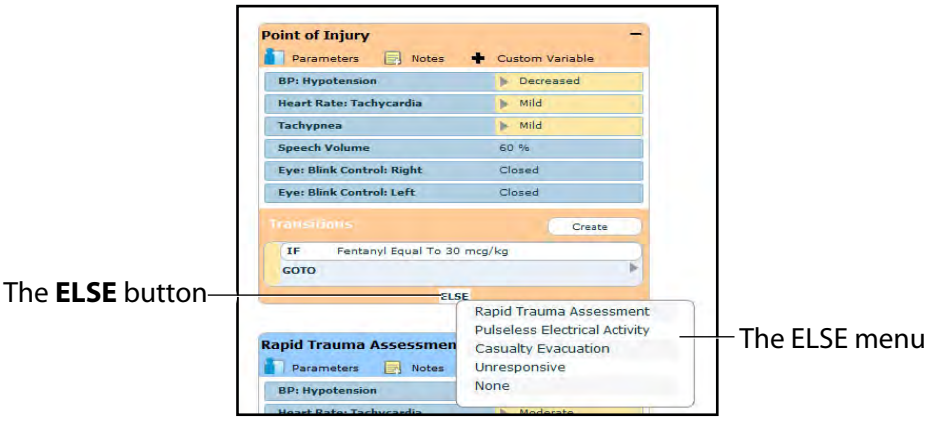
The Scenario Designer

ELSE Transitions

An ELSE transition is used to transition to a state automatically when none of the other programmed transitions occur.

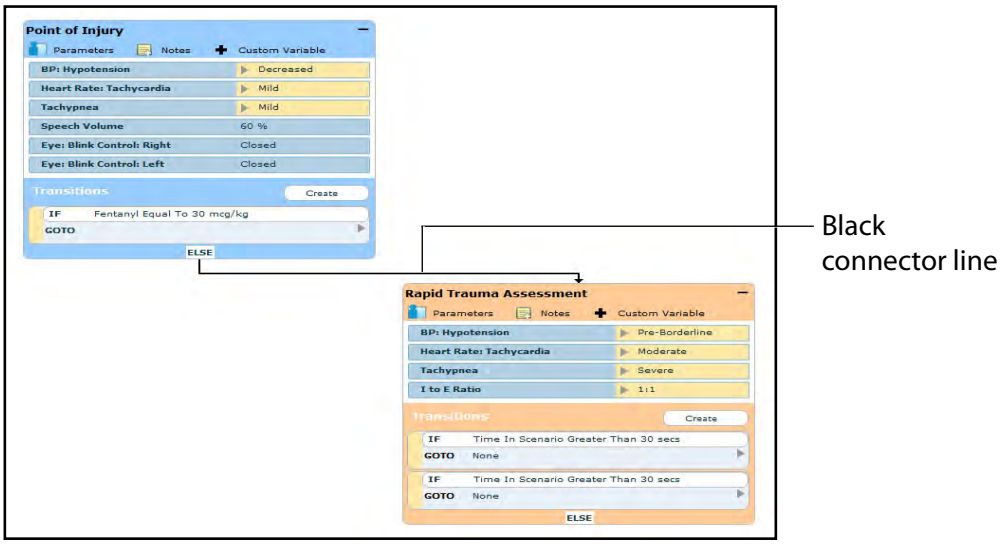
Before specifying an ELSE transition from a state, the state must first contain at least one other transition.

To add an ELSE transition, click **ELSE** in the original state. The ELSE menu appears, listing all the available states.



The Scenario Designer

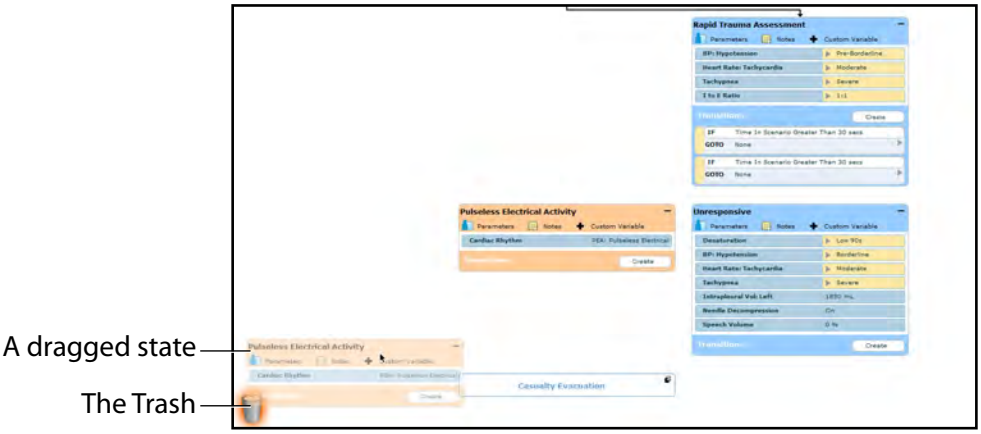
Select the desired state. A black connector line appears, indicating that the states are now linked by an ELSE transition.



The Scenario Designer

Deleting Scenario States

To delete a state, drag and drop the state into the Trash.



The Scenario Designer

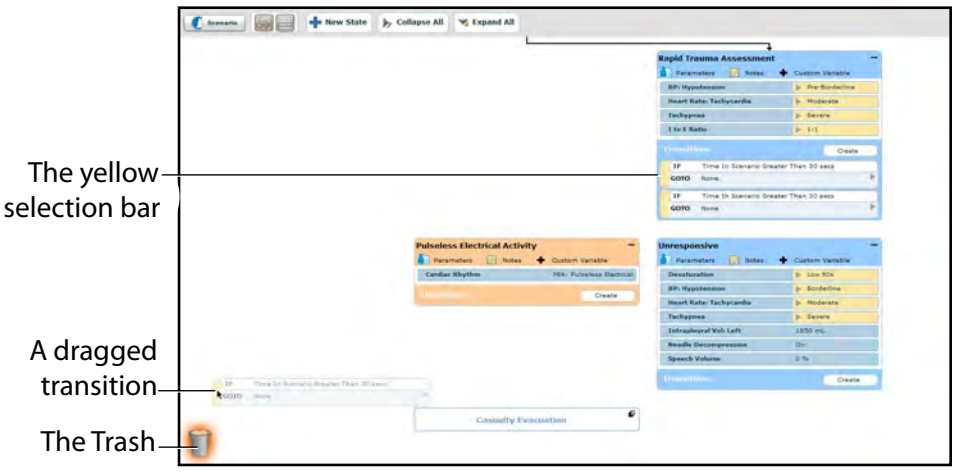
States can be dragged and dropped to the Trash from the Graphical view or the Line Item view.

Deleted states remain in the Trash until you log out of the software or the Trash is cleared.

Deleting Parameters and Transitions

To delete a parameter or transition, from an active state, drag and drop the desired parameter or transition into the Trash.

To drag a parameter, click anywhere within the parameter. To drag a transition, click the yellow selection bar to the left of the transition.



The Scenario Designer

Parameters and transitions can be dragged and dropped to the Trash from the Graphical view or the Line Item view.

Deleted parameters and transitions remain in the Trash until you log out of the software or the Trash is emptied.

Saving the Scenario

At any time during scenario creation or modification, the scenario can be saved.

To save a scenario:

1. Click the **Scenario** button in the upper left of the Scenario Designer.

   The Scenario drop-down menu appears.

The Scenario Drop-Down Menu

2. To save the most recent version of a modified scenario, click **Save**,

   OR

   To save a modified scenario as a new scenario, leaving the original scenario intact:

   a. Click **Save As**.

      When **Save As** is clicked, the Save Scenario dialog box appears.

The Save Scenario Dialog Box

   b. Enter the name for the scenario in the **Enter scenario name** field.

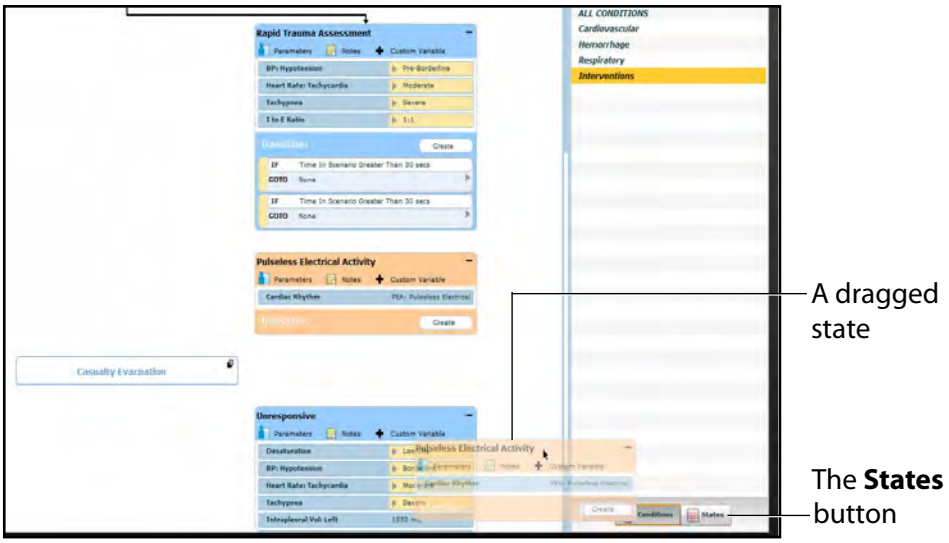
   c. Click **Save**.

NOTE: When naming a scenario, the scenario name CANNOT exceed 128 characters. Additionally, scenario file names CANNOT contain any special characters, such as / \ : * ? < > % |"

Saving States to the State Library

Users can save states to the State Library for later use.

To save a state, drag and drop the state to the **States** button.



The Scenario Designer

The state is stored in the library.

To access the State Library, click the **States** button in the bottom right corner of the Scenario Designer.

The States Button

The State Library appears, listing all saved states.

The State Library

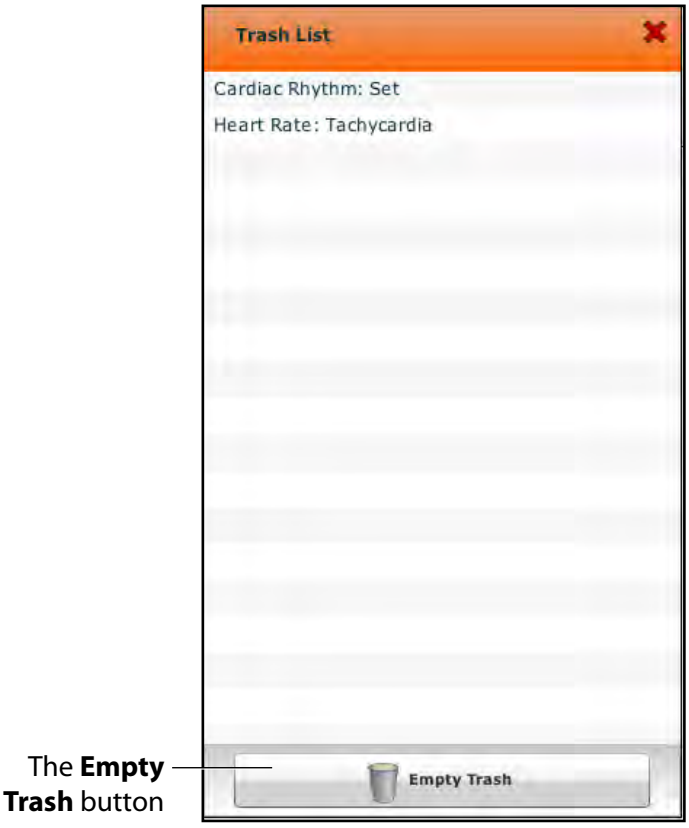
Click **Conditions** to exit the State Library.

Emptying the Trash

To empty the Trash, click the **Trash** icon in the lower left corner of the Scenario Designer.

The Scenario Designer

The Trash List appears.



The Trash List

Click **Empty Trash** to empty the Trash. If you do not wish to delete the items listed, they can be dragged back into the scenario, at which time they are removed from the Trash.

Logging out of the software automatically empties the Trash.

IMPORTANT: Items emptied from the Trash cannot be retrieved.

Administrative Tools

The Müse software has administrative tools that allow users to manage logs, stored content, users and system settings. The administrative tools are accessed via the Administrative Tools buttons, located on the Home page.

The Administrative Tools Buttons

Click the **History** button to view and manage simulation session logs.

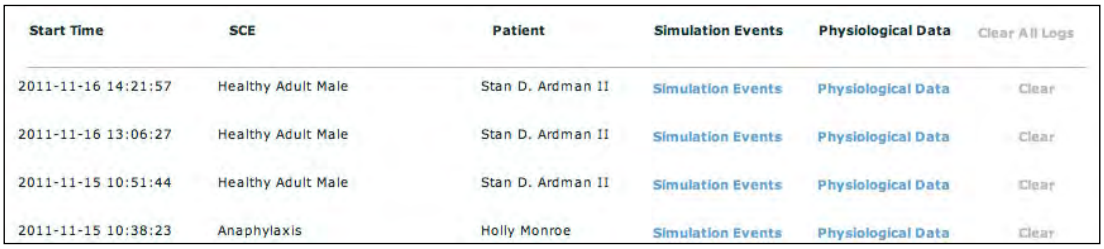
Click the **System Administration** button to manage stored content, user accounts, groups and system settings.

Click the **Account Profile** button to manage and determine preferences for the active account.

IMPORTANT: Changes made to Müse for HPS (e.g., account creation, content management, medication preferences) DO NOT affect Müse for PediaSIM HPS. If a user requires access to both Müse for HPS and Müse for PediaSIM HPS, separate accounts must be created within Müse for HPS and Müse for PediaSIM HPS. Additionally, data backup performed from within Müse for HPS does not back up data associated with Müse for PediaSIM HPS.

History

From the History screen, users can view and export simulation session logs. Each simulation session is listed with the Start Time, the title of the SCE and the Patient's name. In addition, the Physiological Data and Simulation Events are available for review and export.



Start Time	SCE	Patient	Simulation Events	Physiological Data	Clear All Logs
2011-11-16 14:21:57	Healthy Adult Male	Stan D. Ardman II	Simulation Events	Physiological Data	Clear
2011-11-16 13:06:27	Healthy Adult Male	Stan D. Ardman II	Simulation Events	Physiological Data	Clear
2011-11-15 10:51:44	Healthy Adult Male	Stan D. Ardman II	Simulation Events	Physiological Data	Clear
2011-11-15 10:38:23	Anaphylaxis	Holly Monroe	Simulation Events	Physiological Data	Clear

The History Screen

By clicking the **Simulation Events** link of a Simulation Session, users can view the entire log of the simulation and all the events that occurred during the SCE.

When the **Physiological Data** link of a Simulation Session is clicked, users can view all the physiological data that occurred during the SCE.

On both the Simulation Events and Physiological Data screens, there is an **Export** button that, when clicked, exports the data to a CSV file that can be stored on an external device.

System Administration

From the System Administration screen, users can control and access Content Management, User Accounts, Groups, Maintenance and System Settings.

To access the System Administration screen, click the **System Administration** button from the Home page.

The System Administration Button

The System Administration screen is displayed.

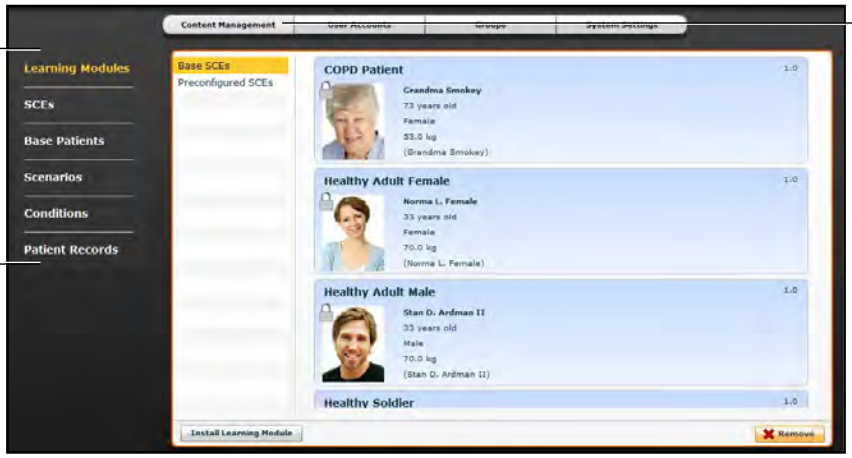
The System Administration Screen

Content Management

From the Content Management options, users can manage learning applications, SCEs, Base Patients and Scenarios.

To access the Content Management options, from the System Administration screen, click **Content Management**.

The Content Management options appear.



The **Content Management** button

The Content Management options

The System Administration Screen

Learning Modules

From the Learning Modules panel, learning applications can be installed or deleted.

When the Content Management button is selected, the Learning Modules panel appears by default. If another panel has been selected, return to the Learning Modules panel by clicking the **Learning Modules** link.

The Learning Modules Panel

To install a learning application:

1. Click **Install Learning Module**.

   The Select file to upload dialog box appears.

2. Locate the correct learning application file on the external storage device or the hard drive location where the SCE file is saved. The file extension is **mlm**.

3. Select the file and click **Select** or **Open**.

4. Refresh the screen by clicking the **Home** button in the Müse software and then return to the Learning Modules panel.

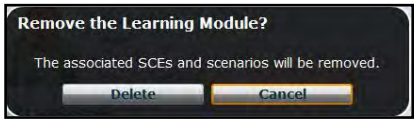
   The learning application appears on the Learning Modules panel and is available for use.

To delete a learning application from Müse:

1. Select a learning application from the Learning Applications panel.

2. Click the **Remove** button.

   The Remove Learning Module warning appears.



The Remove Learning Module Warning

3. Click **Delete**.

   The learning application and all its SCEs are deleted.

   NOTE: Preconfigured learning applications cannot be deleted. If a user attempts to delete them, a failure message appears.

SCEs

From the Content Management options, click **SCEs** to access the SCEs panel.

The SCEs panel appears.

The SCEs Panel

All user-created SCEs are listed in the SCEs panel.

On the SCEs panel, users can review, copy, delete, import and export the SCEs they have created.

NOTE: SCEs purchased from CAE Healthcare CANNOT be exported.

Click **Import SCE** to import an SCE from an external device or the hard drive location where the SCE file is saved. Click **Export** to export an SCE to an external device. The SCE file extension is **sce**.

Base Patients

From the Content Management options, click **Base Patients** to access the Base Patients panel.

The Base Patients panel appears.

The Base Patients Panel

All Patients are listed in the Base Patients panel.

From the Base Patients panel, users can rename, review, delete and export Patients they have created by clicking the respective buttons next to each Patient.

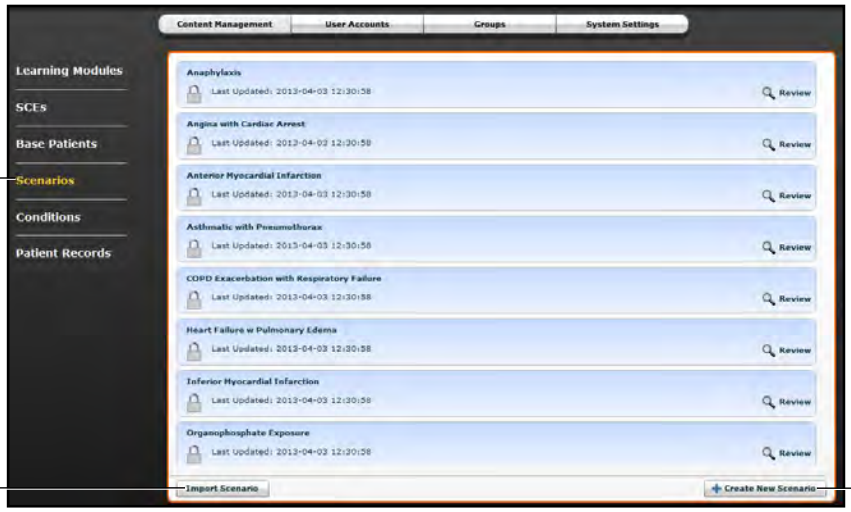
Click **Import Patient** to import a Patient file from an external device or the hard drive location where the SCE file is saved. Click **Export** to export a Patient file to an external device. The Patient file extension is **pat**.

NOTE: Preconfigured CAE Healthcare Base Patients CANNOT be exported.

Scenarios

From the Content Management options, click **Scenarios** to access the Scenarios panel.

The Scenarios panel appears.



The Scenarios Panel

All Scenarios are listed in the Scenarios panel.

From the Scenarios panel, users can rename, review, delete, import and export Scenarios they have created by clicking the respective buttons within each scenario. Locked Scenarios can only be reviewed.

Users can also create new scenarios from the Scenarios screen by clicking the **Create New Scenario** button.

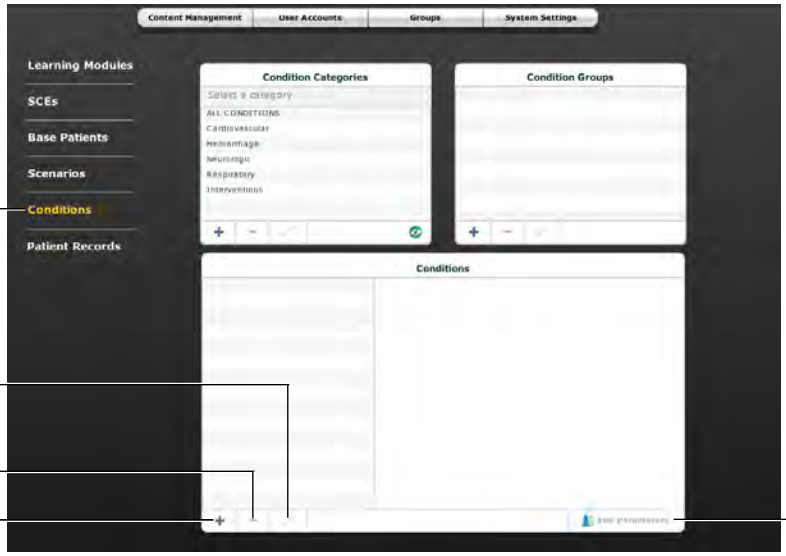
Click **Import** to import a scenario file from an external device or the hard drive location where the SCE file is saved. Click **Export** to export a scenario file to an external device. The scenario file extension is **mss**.

NOTE: Preconfigured CAE Healthcare scenarios CANNOT be exported.

Conditions

From the Content Management options, click **Conditions** to access the Conditions Editor.

The Conditions Editor appears.



The Conditions Editor

All conditions can be viewed in the Conditions panel by selecting their associated categories and groups from the Condition Categories and Condition groups panels.

From the Conditions Editor, users can create new Conditions to be used in SCEs. To create a new condition:

1. From the Condition Categories panel, select a category.

   NOTE: Conditions CANNOT be added to the **Interventions** category.
2. From the Condition Group panel, select a group.
3. In the Conditions panel, click the **Add** button.

   The New Condition Name dialog box appears.
4. Enter a name for the condition in the New Condition Name dialog box.
5. Click **Save**.

   The condition is added to the selected Condition category and group.
6. From the Conditions panel, select the new Condition.
7. Click the **Edit Parameters** button.

   The Parameters screen appears.
8. From the Parameters screen, select the desired Condition parameters.
9. Click **Complete**.

   The condition is saved with the selected parameters.

New condition categories and groups can also be added by clicking the **Add** button in the Condition Categories and Condition Groups panels.

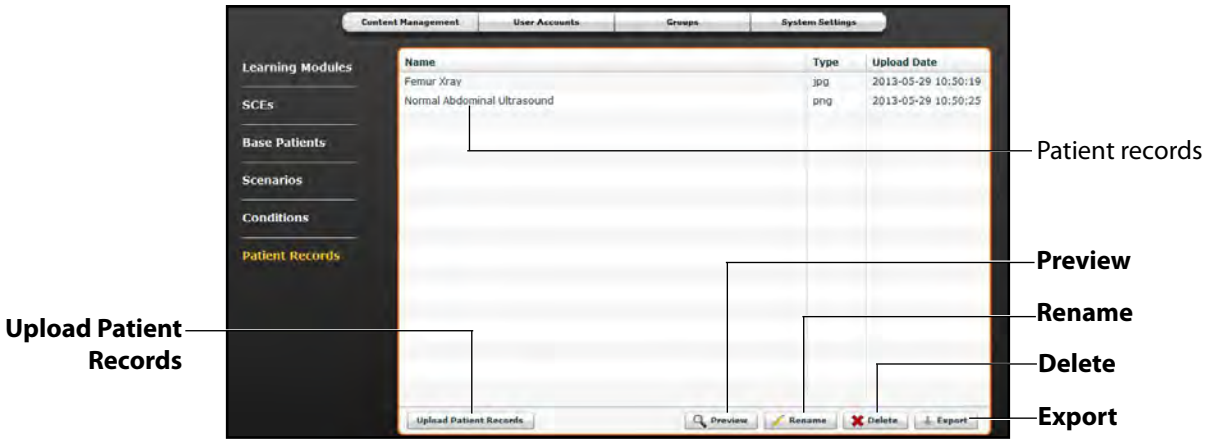
Use the **Delete** and **Rename** buttons in each panel to delete or rename a Condition, group or category.

NOTE: CAE Healthcare Conditions, groups and categories cannot be deleted or renamed.

Patient Records

Patient records can be uploaded to Müse for display in the TouchPro software. Once uploaded, a patient record is available for use with any SCE.

Patient Records are managed from the Patient Records panel on the **Content Management** tab of the System Administration screen.



The Patient Records Panel

The following patient record file types can be uploaded to Müse:

- JPG or JPEG images
- GIF images
- PNG images
- XPS images
- PDF documents
- MPEG videos
- MOV videos
- MP3 audio files

A single patient record file cannot exceed 20MB.

To upload a patient record:

1. From Patient Records panel, click **Upload Patient Records**.

   A file selection window appears.

2. Select the desired file and click **Open** or **OK.**

   The file is uploaded and is now available to display in the TouchPro software.

Müse can store up to 100GB of patient record files. To ensure adequate space, please delete patient records when they are no longer needed.

To delete a patient record:

1. From the Patient Records panel, select the patient record to delete**.**
2. Click **Delete**.

   The patient record is deleted and is no longer available to display in the TouchPro software.

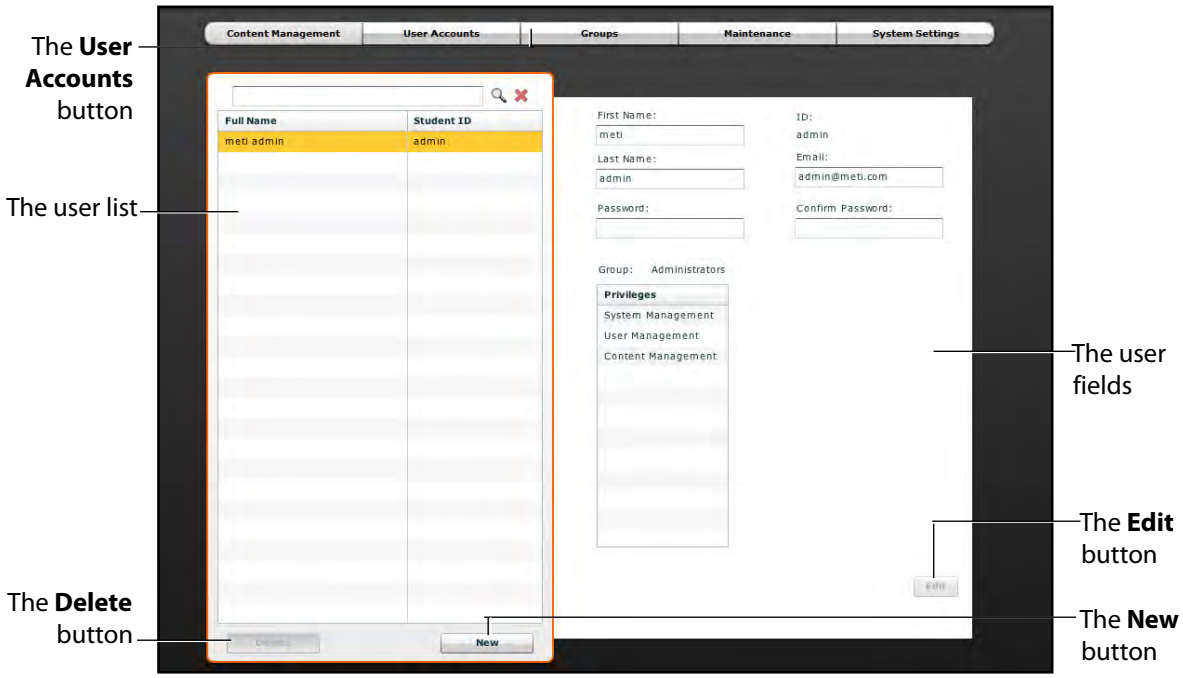
Individual patient records can also be previewed, renamed or exported by selecting the record and clicking **Rename**, **Export** or **Preview**.

For information about displaying patient records in TouchPro, see *Displaying Patient Records on page 62*.

User Accounts

To access the User Accounts panel, from the System Administration screen, click the **User Accounts** button. The User Accounts panel appears.

From the User Accounts panel, users can create, edit and delete users.



The User Accounts Panel

NOTE: User Accounts functions are available only to users with the User Management or System Management privilege.

IMPORTANT: Changes made to Müse for HPS DO NOT affect Müse for PediaSIM HPS. If a user requires access to both Müse for HPS and Müse for PediaSIM HPS, separate accounts must be created within Müse for HPS and Müse for PediaSIM HPS.

Creating a User

To create a new user:

1. From the User Accounts panel, click **New**.

   The New Account Creation panel appears.
2. In the New Account Creation panel, enter the user's personal data and choose a password.
3. Assign the user to a group by selecting a group from the **Group** menu.

   NOTE: A user can only be assigned to one group.
4. Click **Create**.

   The new user is created and the New Account Creation panel disappears.

Editing a User

To edit a user's information or privileges:

1. On the User Accounts panel, select the user to edit.
2. Click **Edit**.

   The user fields become editable.
3. Make the desired changes.
4. Click **Save**.

Deleting a User

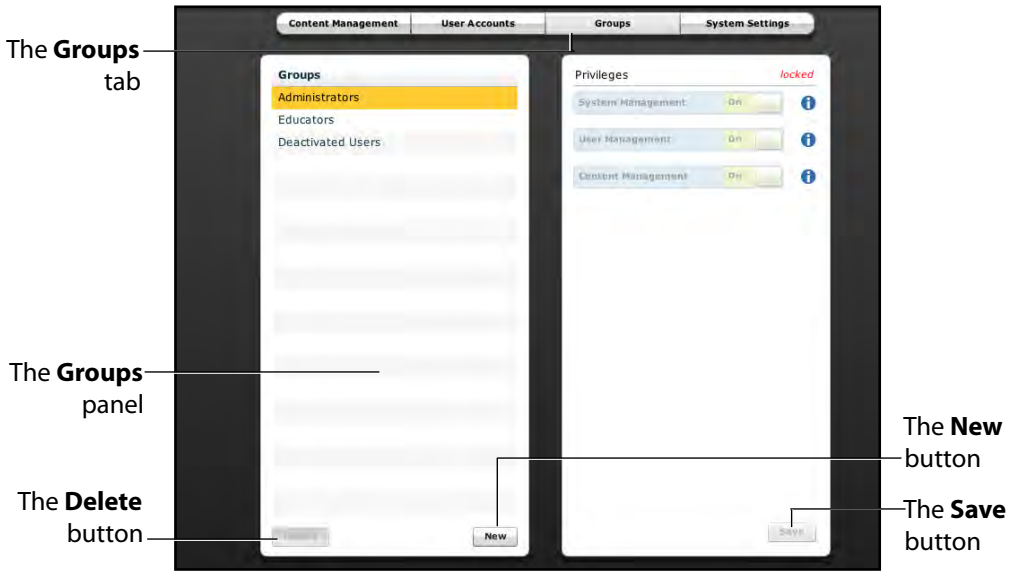
To permanently delete a user, from the User Accounts panel, select a user and click **Delete**. When the User Deletion Warning box appears, click **Yes**.

The user account and the data associated with it are deleted. However, the administrative user deleting the account becomes the owner of any SCEs, scenarios or patients created by the user being deleted (i.e., the SCEs, scenarios and patients created by the deleted user are moved to the deleting user's account).

Groups

Users are assigned to groups to define access privileges. To access the Groups panel, from the System Administration screen, click **Groups**.

The Groups panel appears.



The Groups Panel

NOTE: Groups functions are available only to users with the User Management or System Management privilege.

From the Groups panel, users can create new groups, delete groups and assign privileges to groups.

In the Groups panel, three groups appear by default:

- Administrators
- Educators
- Deactivated Users

Each default group has privileges assigned.

Privilege System

The Müse software has three different privileges:

- System Management
- User Management
- Content Management

User Management and Content Management can be assigned independently or combined. The System Management privilege contains all privileges.

System Management

Users with the System Management privilege have access to all features of the Müse software, including the benefits of the User Management and Content Management privileges, listed below. Users with the System Management privilege can also view system settings, back up and restore data and apply software updates.

User Management

Users with the User Management privilege can manage all users and groups.

Content Management

Users with the Content Management privilege can create and manage all SCEs.

Creating a New Group

To create a new Group:

1. From the Groups panel, click **New**.

   The **Group Name** field appears.
2. Enter the name of the Group in the **Group Name** field.
3. Click **Create Group**.

   The group appears in the Groups panel. Privileges can now be selected.
4. Select the privilege(s) to be assigned to the Group.
5. Click **Save**.

Deleting a Group

Groups can be deleted when they are no longer needed. Once a Group is deleted, all users who were affiliated with the Group are moved to the Deactivated Users Group.

To permanently delete a Group, select the group to be deleted from the Groups panel and click **Delete**. When the Group Deletion warning box appears, click **Yes**.

Providing Access to Content Only

To provide users with the ability to create and manage SCEs but not the ability to manage users or groups:

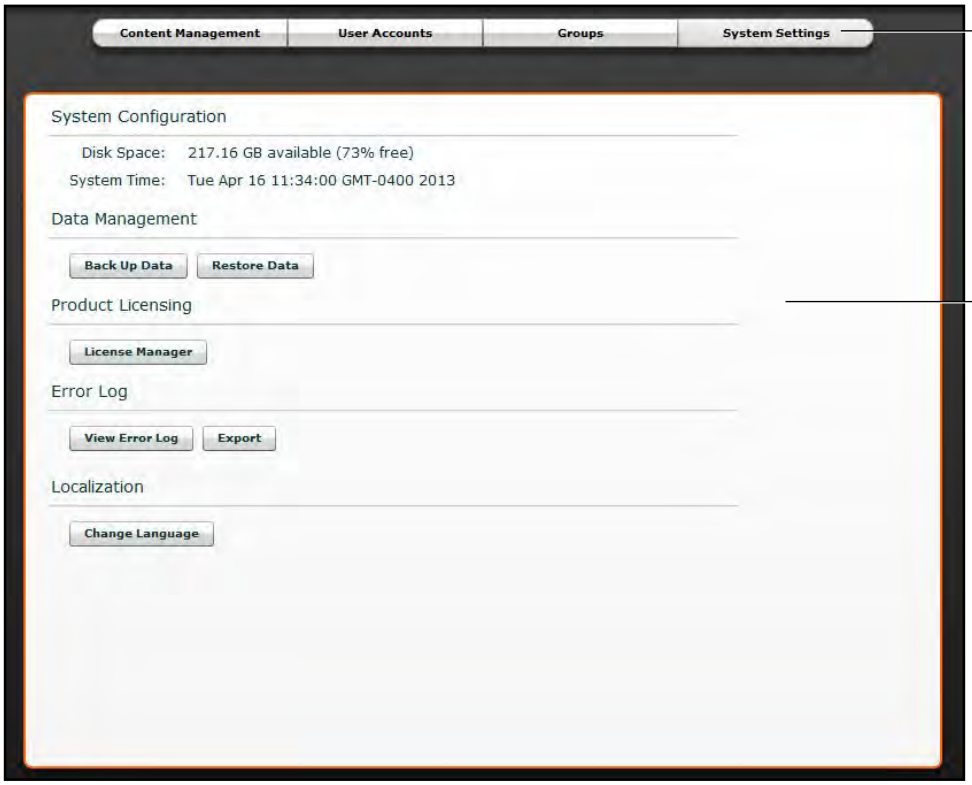
1. Create a new group called Content Only.
2. Assign the group the Content Management privilege. Do NOT assign any other privileges to the group.
3. On the **User Accounts** tab, create or edit the desired users, placing each user in the Content Only group.

System Settings

From the System Settings panel, users can manage the System Configuration, Data Management and Product Licensing of the Müse software.

To access the System Settings panel, from the System Administration screen, click **System Settings**.

The System Settings panel appears.



The System Settings Panel

NOTE: System Settings functions are available only to users with the System Management privilege.

System Configuration

Under System Configuration, Disk Space and System Time are displayed.

Data Management

The Data Management feature allows users to back up data to an external device. Users can also restore the backup data.

Backing Up Data

Back up data to protect and store content and user data.

To back up data:

1. On the System Settings panel, click the **Back Up Data** button.

The Back Up Data Button

   A Save dialog box appears.
2. Select a location to save the backed up data.
3. Click **Save**.

IMPORTANT: To protect content and user information, data should be backed up weekly.

IMPORTANT: Data backup performed from Müse for HPS does not back up data associated with Müse for PediaSIM HPS.

Restoring Data

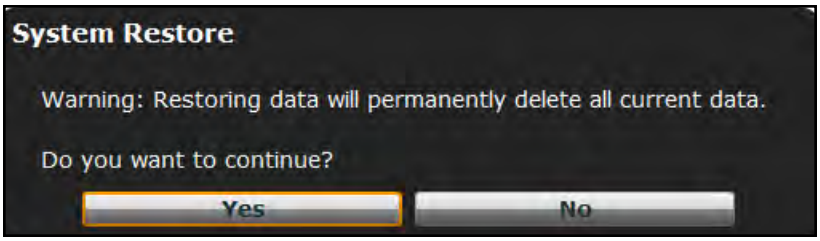
Restore data when the backed up data needs to be replaced on the software. Restoring data only restores the last backup and does NOT merge the backup data with the current data.

To restore backup data:

1. On the System Settings panel, click **Restore Data**.

The Back Up Data Button

The System Restore warning box appears stating that restoring data erases all current data and asks if you want to continue.



The System Restore Warning Box

IMPORTANT: Restoring data ERASES all current data and replaces it with the backed up data.

2. Click **Yes**.

   A select file dialog box appears.

3. Locate the appropriate .bak backup file to restore.
4. Click **Select**. The data is restored.

   IMPORTANT: Restoring Müse for HPS data does not restore Müse for PediaSIM HPS data.

Product Licensing

To view product licensing information for your simulator or to enter a license key to activate your software, click **License Manager**.

Error Log

The Error Log is available for technicians and is used when diagnosing the Müse software.

IMPORTANT: Do not clear the Error Log.

Localization

To change the language of the Müse software:

1. From the System Settings panel, under the Localization heading, Click **Change Language**.

   The Change Language dialog box appears.

2. Select a language from the dialog box.

3. Click **Accept**.

   The Müse user interface changes to the selected language.

NOTE: Only the English version of the User Guide is available via the software, regardless of the Müse language selection. To access the User Guide in other languages, please visit www.caehealthcare.com and click the **Support** link.

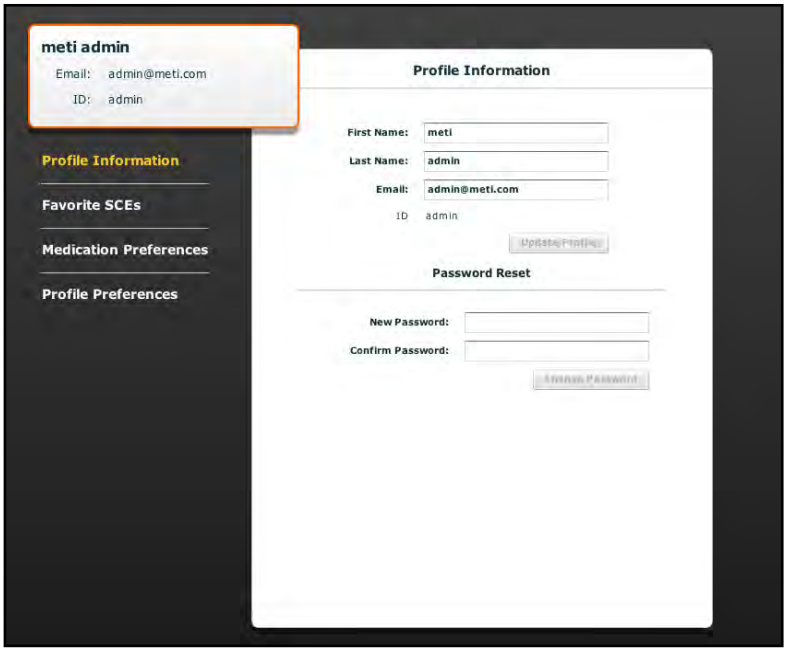
Account Profile

From the Account Profile screen, users can view, update and reset personal profile information. Users can also view and add favorite SCEs from this screen.

Click the **Account Profile** button to access the Account Profile features.

The Account Profile Button

The Account Profile screen appears.

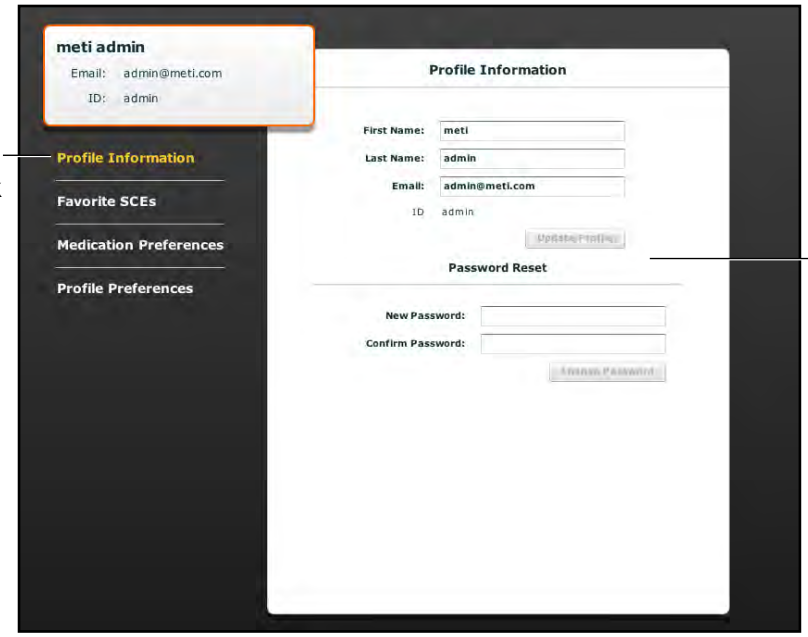


The Account Profile Screen

Profile Information

From the Account Profile screen, the Profile Information panel appears by default. If another panel has been selected, click **Profile Information** to return to the Profile Information panel.

From the Profile Information panel, users can change their profile information and reset their passwords.



The Account Profile Screen

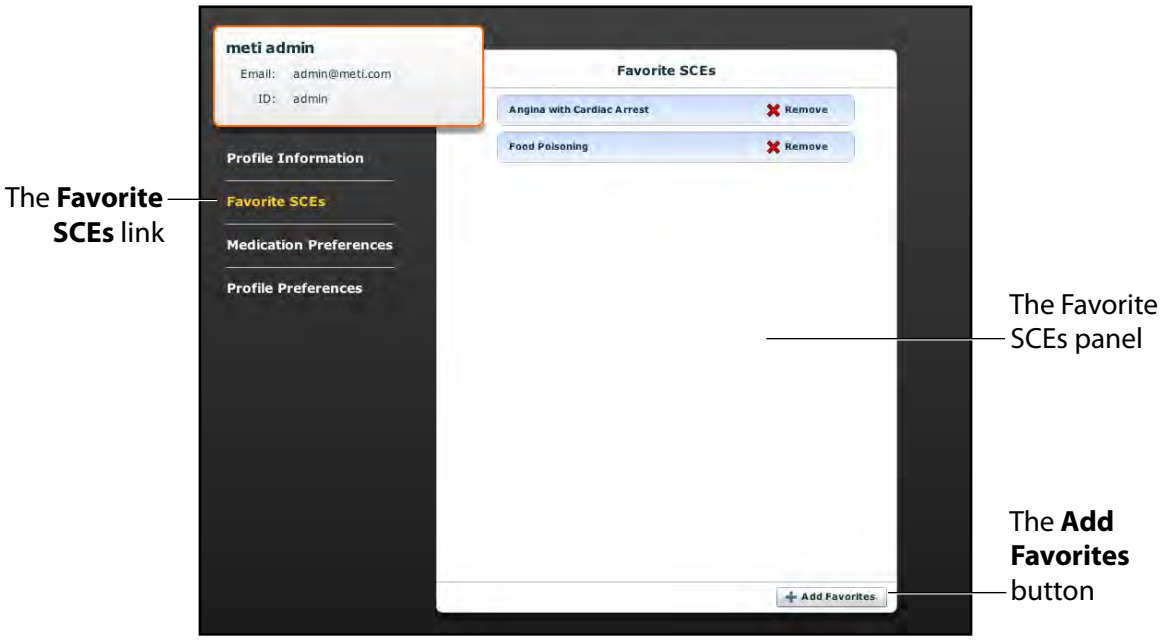
To change profile information, enter the new information in the appropriate fields and click **Update Profile** when finished.

To reset a password, enter the new password in the **New Password** field and re-enter the new password in the **Confirm Password** field. Click **Change Password** when finished.

IMPORTANT: If you change your username or password, you MUST use the new username and/or password upon your next login. You cannot access the system with the old username or password once it has been changed.

Favorite SCEs

To access the Favorite SCEs panel, click **Favorite SCEs** from the Account Profile screen. All of the logged-in user's favorite SCEs appear in the Favorite SCEs panel.



The Account Profile Screen

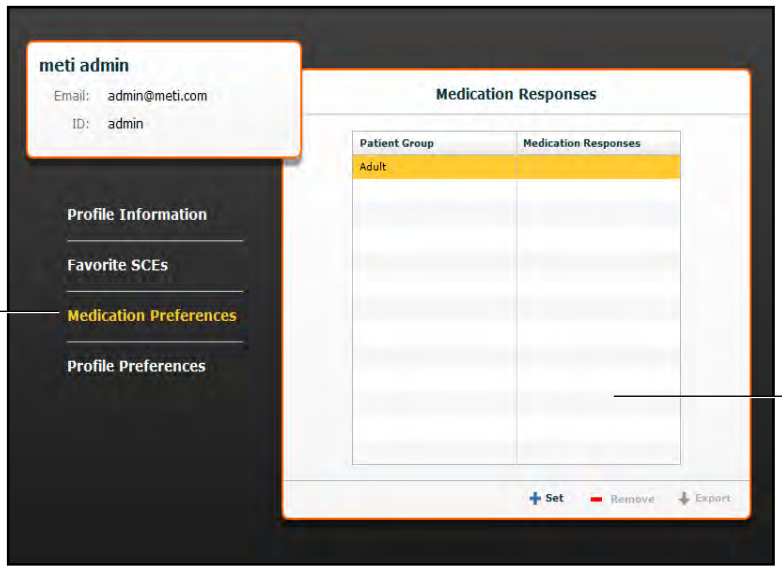
To add SCEs to the Favorite SCEs panel, click **Add Favorites**. The SCE Library appears. Select the desired SCE and it automatically appears in the Favorite SCEs panel.

Medication Preferences

From the Medication Preferences panel, users can import customized medication response files created in the Pharmacology Editor software.

To access Medication Preferences, click **Medication Preferences** on the Account Profile screen.

The Medication Preferences panel appears.



The Account Profile Screen

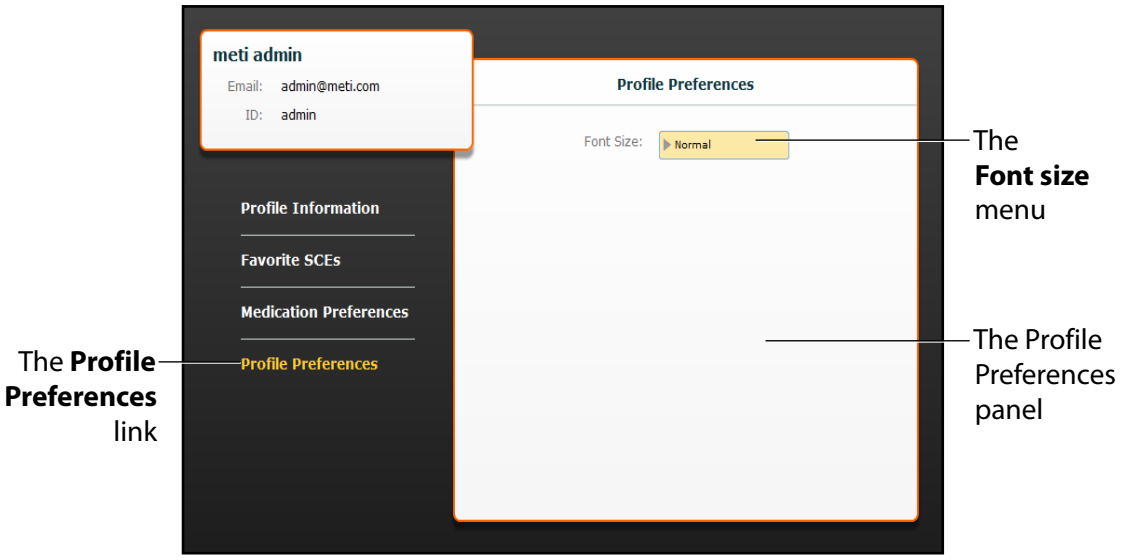
To import medication response files, click the **Set** button. The select file dialog box appears. Select the medication response file to be added and click **Open** or **OK**.

Profile Preferences

From the Profile Preferences panel, users can change the font size used in the software.

To access Profile Preferences, click **Profile Preferences** on the Account Profile screen.

The Profile Preferences panel appears.



The Account Profile Screen

To change the font size, click on the **Font size** selection. The **Font size** drop-down menu appears.

From the **Font size** drop-down menu, select **Normal**, **Small** or **Large**.

USING TOUCHPRO

The TouchPro software enables users to view patient physiology.

The software can be used from the Instructor Workstation or on another computer provided the computer has joined the simulator's wireless network.

IMPORTANT: Only two TouchPro software screens can be open at a time.

Accessing the TouchPro Software

Like the Müse software, the TouchPro software is compatible with computers that have touch-screen capabilities.

To run the TouchPro software, the Instructor Workstation must be connected to the simulator's network.

IMPORTANT: An SCE must be running on the Müse software for any physiological data to be displayed on the TouchPro software. The TouchPro software can only show one Patient at a time.

To launch TouchPro from the Instructor Workstation:

1. With the Müse software running, open a new tab in the web browser and go to the **Home** page of the web browser.

   The Müse Start Screen appears.

The Müse Start Screen

2. Select the **TouchPro** icon.

When TouchPro opens, the simulated patient monitor appears.

The TouchPro Display

NOTE: The capnogram waveform is not displayed on the TouchPro software from the Instructor Workstation. Capnogram information can be found on the clinical patient monitor if one is connected to the simulator.

Modifying the TouchPro Display

The layout of the waveforms and numeric data shown on the TouchPro software can be customized.

The TouchPro software can show up to six waveforms plus an additional four numeric readouts.

Selecting a Preconfigured Layout

There are five preconfigured CAE Healthcare Layouts:

ICU-Arterial Line Only - preconfigured with waveform and numeric readouts for ECG Lead II, ECG Lead V, ABP, Pleth and a numeric readout for Body Temperature.

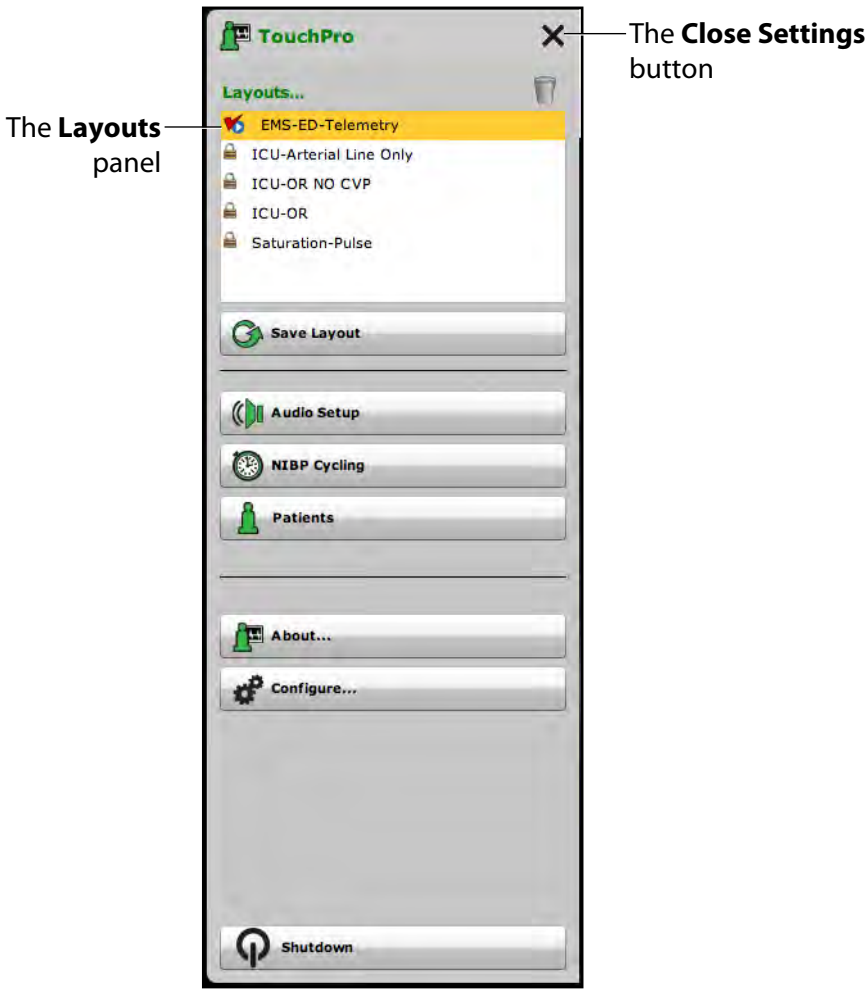
EMS-ED-Telemetry - preconfigured with a waveform and numeric readout for ECG Lead II and numeric readouts for SpO_2 and noninvasive blood pressure (NIBP).

ICU-OR No CVP - preconfigured with waveform and numeric readouts for ECG Lead II, ECG Lead V, ABP, PAP and Pleth, and numeric readouts for NIBP, Thermodilution C.O., Blood Temperature and Body Temperature.

ICU-OR - preconfigured with waveform and numeric readouts for ECG Lead II, ECG Lead V, ABP, PAP, CVP and Pleth, and numeric readouts for NIBP, Thermodilution C.O., Blood Temperature and Body Temperature.

Saturation-Pulse - preconfigured with numeric readouts for SpO_2 and pulse.

To select a preconfigured layout, click **Settings**, select the layout from the Layouts panel and click the **Close Settings** button.



The TouchPro Settings Menu

NOTE: Preconfigured layouts must be enabled in the Müse TouchPro Setup for the currently running SCE to be accessible in the Layouts panel..

For more infomation about enabling preconfigured layouts, see *Modifying the TouchPro Setup on page 97*.

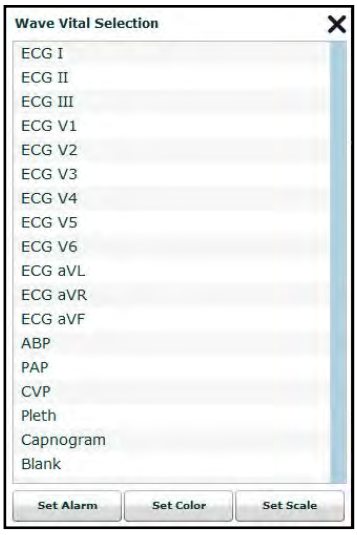
Changing a Waveform or Numeric Display

Waveforms and numeric displays can be changed to suit the user's needs.

To change a waveform or numeric display:

1. Click the waveform or numeric to be changed.

   The Wave Vital Selection menu or the Numeric Vital Selection menu appears, displaying all the available waveforms or numerics.



The Wave Vital Selection Menu

2. Select the desired waveform or numeric.

   The new waveform or numeric is reflected on the screen.

From the **Wave Vital Selection** menu, the alarm, color and scale can be set for the waveform using the **Set Alarm**, **Set Color** and **Set Scale** buttons. From the **Numeric Vital Selection** menu, the color and alarm for the numeric can also be established using the **Set Color** and **Set Alarm** buttons.

Adding a Waveform

The TouchPro software supports up to six waveforms.

To add a waveform:

1. Click the **Settings** button in the bottom right corner of the TouchPro display.

The Settings Button

The Settings menu opens and the **Add Waveform** and **Remove Waveform** buttons appear.

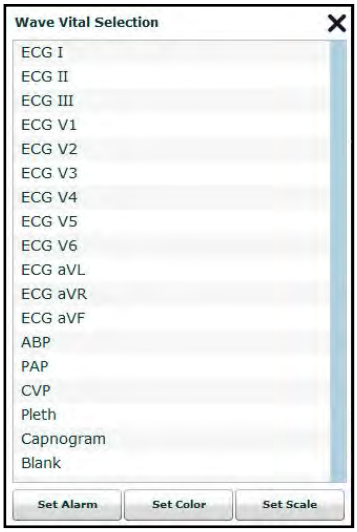
2. Click the plus button in the location above which you want the empty waveform to appear.

   An empty waveform field appears.

The TouchPro Display Settings

3. Click the empty waveform field.

The Wave Vital Selection menu appears.



The Wave Vital Selection Menu

4. Select the desired waveform from the Wave Vital Selection menu.

   The new waveform is reflected on the screen.

Adding a Numeric Display

The TouchPro software contains four numeric display fields. All four numeric display fields are located on one row beneath the waveform displays.

When fewer than four numeric readouts are being displayed, the remaining fields are blank.

To add a numeric to a blank display field:

1. Click a blank numeric display field.

The TouchPro Display

The Numeric Vital Selection menu appears.

The Numeric Vital Selection Menu

2. Select the desired numeric.

   The new numeric vital display is reflected on the screen.

Moving a Waveform or Numeric Display

Waveforms and numerics can be moved on the screen to suit the user's needs.

To move a waveform or numeric, click the desired waveform or numeric and drag and drop the display to a desired location.

The TouchPro Display

Saving a Layout

Once a layout has been configured, it can be saved and reused.

To save a layout:

1. Ensure the desired waveforms and numerics are in place.
2. Click **Settings**.

   The Settings menu appears.
3. Click **Save As**.

   The Save Layout window appears.
4. In the Save Layout window, in the **Layout Name** field, enter a name for the layout

The Save Layout Window

5. Click **Save.**
6. Click the **Close** button to exit the Settings menu.

Saved layouts can be deleted from the Settings menu by dragging and dropping them in the Trash.

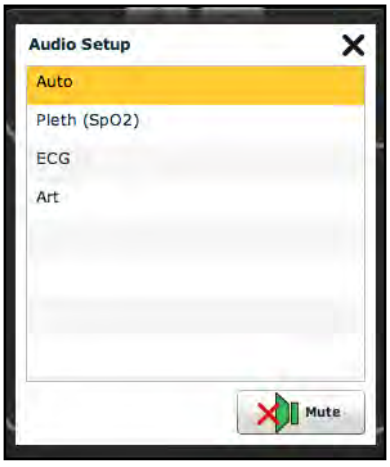
NOTE: When a layout is saved, it is available for use only with the current SCE. To enable the layout for use with any other SCE, enable the layout from the TouchPro Setup panel for the desired SCE.

Sounds

All sounds can be silenced by clicking the **Mute** button in the bottom left corner of the TouchPro display.

The Mute Button

To set up the audio for the TouchPro, from the Settings menu, click **Audio Setup**.



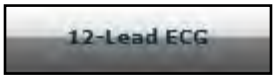
The Audio Setup Menu

From the Audio Setup window, select a waveform to set it as the pulse sound. Once a waveform is selected, the Audio Setup window automatically closes.

Clicking the **Mute** button from the Audio Setup window mutes all alarms. Click the **Mute** button again to return the alarms to their original state.

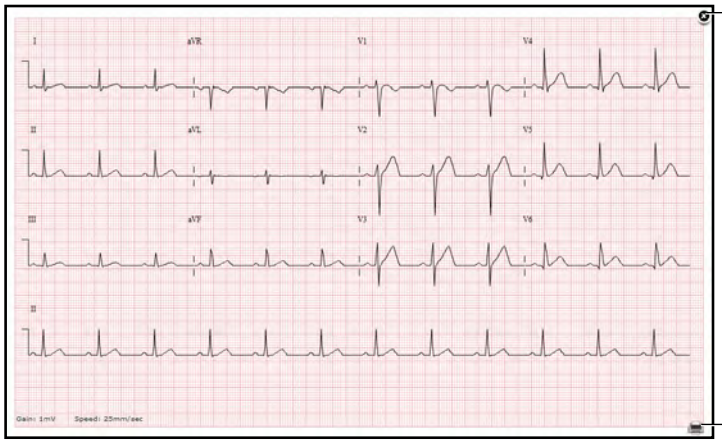
12-Lead ECG

To view a 12-lead ECG report, click the **12-Lead ECG** button at the bottom of the TouchPro screen.



The 12-Lead ECG Button

The report appears.



A 12-Lead ECG Report

The report can be printed or saved by clicking the **Print** button in the bottom right corner of the 12-lead ECG report.

To close the report, click the **Close** button.

IMPORTANT: Prior to saving the report as a PDF or printing to a network printer, the print presets must be adjusted. The page orientation must be set to Landscape and the margins must be set to .25 inches on all sides. These settings vary in location depending on the operating system (i.e., Macintosh or Windows).

To save the report to a PDF file on a Macintosh Instructor Workstation:

1. From the 12-lead ECG report screen, click the **Print** button located in the bottom right corner of the 12-lead ECG report.
2. Select the Save As PDF option.
3. The report saves as a PDF on the Macintosh Instructor Workstation.

To save the report to a PDF file on a Windows Instructor Workstation:

1. From the 12-lead ECG report screen, click the **Print** button located in the bottom right corner of the 12-lead ECG report.

   The Print dialog box appears.

2. From the drop-down menu, select Microsoft XPS Document Writer.
3. The report saves on the Windows Instructor Workstation.

To print a report:

1. From the 12-lead ECG report screen, click the **Print** button located in the bottom right corner of the 12-lead ECG report.
2. Select the appropriate network printer.

   NOTE: A network printer must be configured in order to appear as an option.

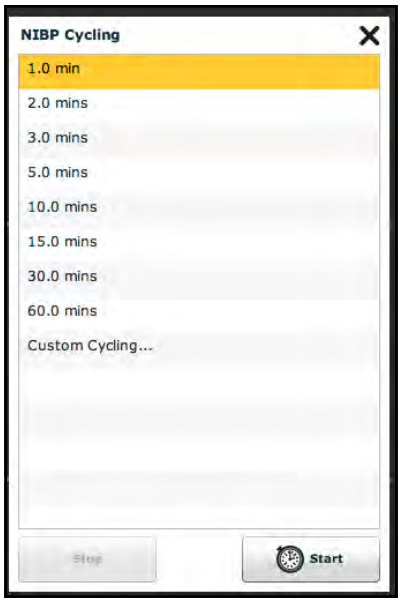
3. Click the **Print** button.

   The report prints to the designated network printer.

NIBP Cycling and Manual NIBP

When non-invasive blood pressure (NIBP) is displayed, the patient's NIBP can be updated at specified intervals using NIBP Cycling, or the current NIBP can be displayed immediately using the **Manual NIBP** button.

To set the patient's NIBP to be updated at regular intervals, from the Settings menu, click **NIBP Cycling**. The NIBP Cycling menu appears. From the NIBP Cycling menu, select the desired interval for the cycling and click **Start**.



The NIBP Cycling Menu

Custom cycling is also available.

To display the patient's current NIBP, click the **Manual NIBP** button.

The TouchPro Display

The current NIBP is displayed.

NOTE: Manual NIBP can be used at any time during cycling. However, this turns off auto-cycling.

Patients

To view the available Patients, click the **Settings** button in the lower right corner of the TouchPro screen. The Settings menu appears. From the Settings menu, click **Patients** to view the current Patient.

The Available Patients

NOTE: When connected to the simulator, the TouchPro only displays the active Patient.

Configuring the TouchPro Software

The background color and alarm suspension time can be set from the TouchPro Configure panel.

To access the Configure panel:

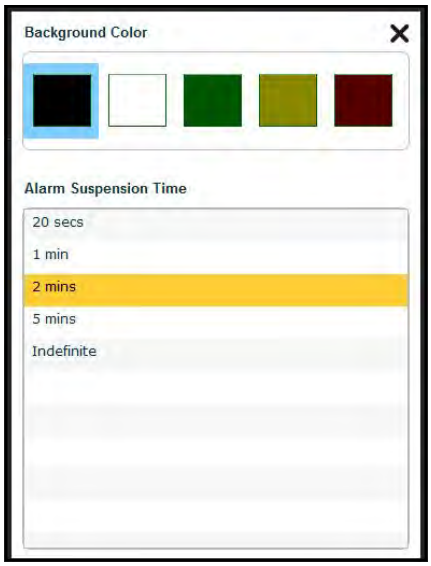
1. Click the **Settings** button in the bottom, right corner of the TouchPro screen.

   The Settings menu appears.

2. From the Settings menu, click the **Configure** button.

   The Configure panel appears.

3. From the Configure panel, set the background color and alarm suspension time.



The Configure Panel

4. Click the **Exit** button to exit the Configure panel when finished.

Changing the TouchPro Language

To change the language of the TouchPro software:

1. Click the **Settings** button in the bottom, right corner of the TouchPro screen.

   The Settings menu appears.

2. From the Settings menu, click the **Language Selection** button.

   The Language Selection panel appears.

3. From the Language Selection panel, select a language.

The Language Selection Panel

4. Click **Accept**.

   The TouchPro software changes to the selected language.

Exiting the TouchPro Software

To exit TouchPro:

1. Click the **Settings** button from the bottom, right corner of the TouchPro screen.

   The Settings menu appears.

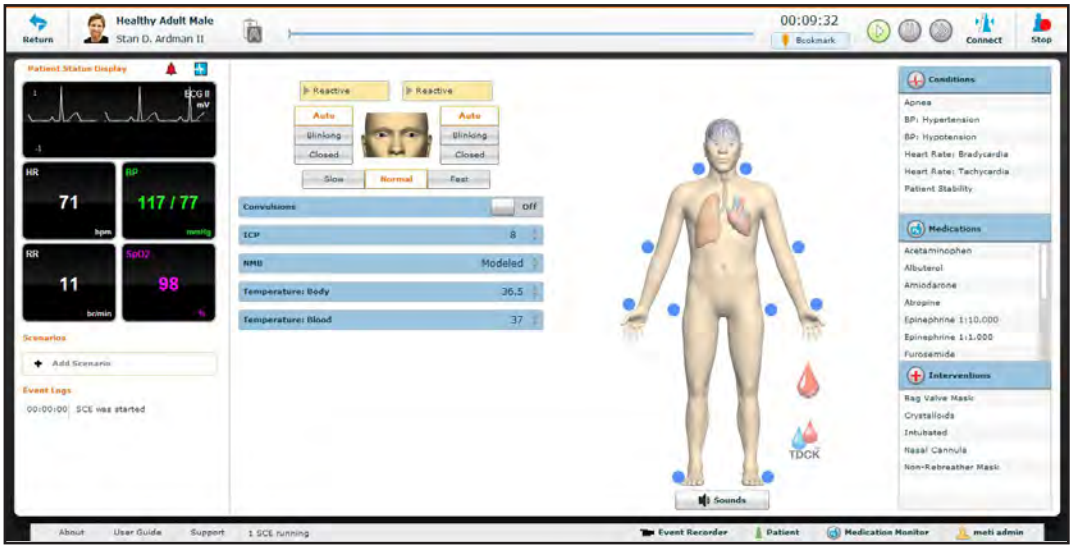
2. From the Settings menu, click **Shutdown**. A warning box appears asking if you want to exit.

3. Click **Shutdown**.

   TouchPro shuts down and the Müse Start Screen appears.

Using the HPS

Once the HPS has been set up (see Section 2: HPS with Müse Setup), the software has been loaded and an SCE started (see Section 3: Using the Software), the simulator is ready for learner interventions. From the Run screen, the features of the HPS can be accessed. They are broken down into the following categories: Neurological, Respiratory, Cardiovascular, Fluids and Sounds.



The Run Screen

NOTE: When switching between running HPS6 software and Müse on the same Instructor Workstation or when switching between connecting the same Instructor Workstation to the HPS simulator and PediaSIM, the HPS Lab Rack should be restarted to ensure accurate functionality.

Parameters

The Müse software has a number of parameters that control the physiological features of the HPS. The parameters are grouped by category: Neurological, Respiratory, Cardiovascular, Fluids and Sounds. Each screen lists default Basic parameters. However, when the **Basic/Additional** switch, located on the Run screen, is activated, more parameters become available.

The Basic/Additional Switch

Below is a table that lists all of the Basic HPS parameters.

Basic Parameters				
Neurological	**Respiratory**	**Cardiovascular**	**Fluids**	**TDCK**
Eyes: Pupil Size	Swollen Tongue	Blood Pressure	Fluid Loss Blood	Hemorrhage Channel 1
Eyes: Blinking	Airway Occluder	Heart Rate	Fluid Loss Plasma	Hemorrhage Channel 2
Convulsions	Laryngospasm	Heart Rate Factor	Colloid Infusion	Hemorrhage Channel 3
ICP	Needle Decompression	Cardiac Rhythm	Crystalloid Infusion	Hemorrhage Channel 4
NMB	Bronchial Occlusion (Left and Right)	Arterial Catheter	PRBC Infusion	Hemorrhage Channel 5
Temperature: Body	Respiratory Rate	Central Venous Catheter	Whole Blood Infusion	Hemorrhage Channel 6
Temperature: Blood	Respiratory Rate Factor	PA Catheter	Urinary Output	Secretion: Nose
	Shunt Fraction	PA Balloon	Bleeding	Secretion: Mouth
	SpO_2	Defib		Secretion: Ear
	NMB	Pacing Current		Secretion: Eye
	Tidal Volume	Pacing Rate		
	Intrapleural Volume: Left	Pacing Capture Threshold		
	Intrapleural Volume: Right	Cold Fluid Inject		
	Fraction of Inspired O_2			
	Chest Tube Flow			

NOTE: If your simulator is capable of simulating convulsions, ensure the convulsions parameter is visible in Müse prior to logging into the software. In the upper right corner of the Müse Start screen, select the **Simulator Features** link, then ensure the **Convulsions** box is checked. This causes the Convulsions parameter to appear on the neurological view in Müse. The convulsions parameter is visible by default.

Additional parameters available are shown in the table below.

Additional Parameters				
Neurological	**Respiratory**	**Cardiovascular**	**Fluids**	**TDCK**
None	Respiratory Rate Tidal Volume Tidal Volume Factor pH Shift PEEP Chest Tube Chest Tube Flow Chest Tube Air Leak O_2 Consumption CO_2 Production Factor $PaCO_2$ Set-point PaO_2 Set-point I to E Ratio (1:X) $PetCO_2$-$PaCO_2$ Factor Respiratory Gain Factor Respiratory Quotient Volume/Rate Control Factor Chest Wall Capacity Chest Wall Compliance Factor Distended Chest Wall Compliance Factor Functional Residual Capacity Lung Compliance Factor: Left Lung Compliance Factor: Right Venous CO_2 Shift	Baroreceptor Maximum Pressure Baroreceptor Minimum Pressure Left Ventricle Contractility Factor Right Ventricle Contractility Factor Systemic Vascular Resistance Factor Venous Capacity Factor Systemic Arteries Compliance Factor Pulmonary Arteries Compliance Factor Pulmonary Vasculature Resistance Factor Venous Return Resistance Factor Baroreceptor Gain (Overall) Factor Baroreceptor Gain (Cardiac) Factor Baroreceptor Gain (Peripheral) Factor Chest Compression Efficacy Tamponade Volume Ischemic Index Sensitivity Ischemic Index Averaging	None	None

Additional Parameters				
Neurological	**Respiratory**	**Cardiovascular**	**Fluids**	**TDCK**
	Bronchial Resistance Factor: Left Bronchial Resistance Factor: Right Alveolar Enflurane Fraction of Inspired Enflurane Alveolar Halothane Fraction of Inspired Halothane Alveolar Isoflurane Fraction of Inspired Isoflurane Alveolar Nitrous Oxide Fraction of Inspired Nitrous Oxide Alveolar Sevoflurane Fraction of Inspired Sevoflurane	Aortic Valve Resistance Factor Mitral Valve Resistance Factor Pulmonic Valve Resistance Factor Pericardiocentesis		

Neurological Features

The HPS can simulate a variety of neurological clinical indicators, such as reactive eyes.

Neurological Features			
Anatomy, Physiology and Clinical Signs	**Clinical Interventions, Patient Monitoring and Scenarios.**	**Software Control**	**Manual Control**
Eyes	**Each eye has reactive pupils and functional eyelids that blink and close**.	The response to clinical intervention must be controlled by the instructor. VIEW: **Neurological** PARAMETER(S): **Eye Controls**	None required.
Convulsions	**The mannequin simulates convulsions.**	The response to clinical intervention must be controlled by the instructor. VIEW: **Neurological** PARAMETER(S): **Convulsions**	None required.
Temperature	**Body and blood temperature measured can be set using these parameters and can be displayed on the Patient Status Display.**	The response to clinical intervention must be controlled by the instructor. VIEW: **Neurological** PARAMETER(S): **Temperature: Body, Blood**	None required.
Thumb Twitch *(Human Patient Simulator - HPS Only)*	**The right arm of the mannequin includes electrode attachments for a standard peripheral nerve stimulator (PNS).**	None required.	None required.

NOTE: If your simulator is capable of simulating convulsions, ensure the convulsions parameter is visible in Müse prior to logging into the software. In the upper right corner of the Müse Start screen, select the **Simulator Features** link, then ensure the **Convulsions** box is checked. This causes the Convulsions parameter to appear on the neurological view in Müse. The convulsions parameter is visible by default.

Eyes

Each eye has reactive pupils and eyelids that blink and close.

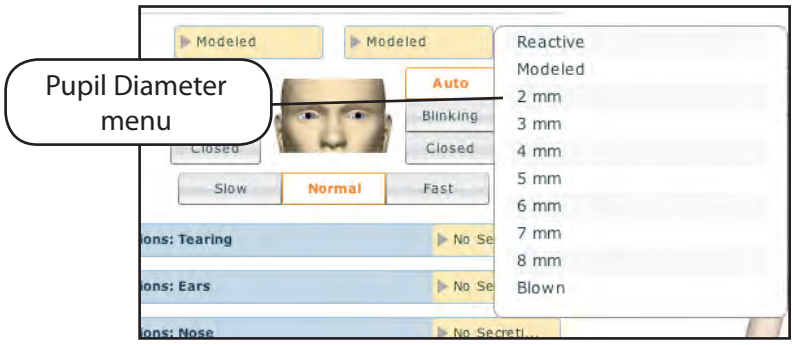
The settings for Pupil Diameter are located on the **Neurological** view and accessed by selecting from the drop-down menu for the appropriate eye.

Currently, there are four pupil options that are used to control the diameter of the pupils in both eyes: **Reactive** (Default)**, Modeled**, **Blown** or a fixed pupil size from 2 mm to 8 mm.

Setting the Pupil Diameter to **Reactive** causes the pupils to re-size in response to changes in light. If both pupils are set to **Reactive**, both pupils re-size accordingly.

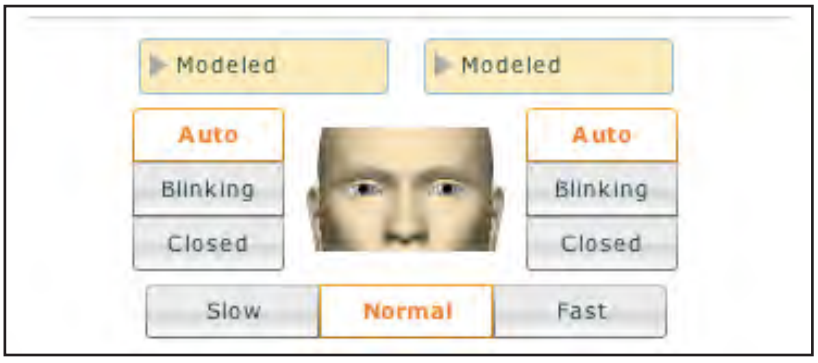
If the Eyes are set to **Modeled**, the pupil size is driven by the pharmacology of morphine.

Other settings allow the user to fix one or both pupils to a specific size.



Altering Pupil Diameter

The settings for Blink Control are located on the **Neurological** view.



Blink Speed Controls

Choosing the **Auto** setting (which is also the default setting) sets the eyes in a blinking mode but allows the simulator to react to physiological changes that cause the eyes to close such as unresponsiveness or a comatose condition.

Though set in the **Closed** position, the eyelids can still be manually opened for clinical inspection.

Additionally, eyelids can be programmed in scenarios to open and close spontaneously or can be fixed in the closed position.

Blinking frequency can be set at one of three speeds: **Normal** (default), **Slow** and **Fast**. To adjust the blinking frequency, click the desired option on the **Neurological** view.

Thumb Twitch

(Human Patient Simulator - HPS Only)

The right arm of the mannequin includes electrode attachments for a standard peripheral nerve stimulator (PNS). The simulator automatically detects the PNS stimulus pattern (single twitch, train-of-four and tetanus). Based upon the stimulus pattern detected, the level of neuromuscular blockade and the type of neuromuscular agent administered (depolarizing or non-depolarizing), the simulator automatically generates the appropriate thumb twitch response.

Respiratory Features

The HPS's anatomically realistic upper airway provides for the opportunity to intubate and apply other airway interventions to the patient, while various clinical signs (e.g., breath sounds, chest excursion, airway patency) can be physically demonstrated. A series of speakers inside the simulator can generate a range of breath and throat sounds used in patient assessment.

Respiratory Features			
Anatomy, Physiology and Clinical Signs	**Clinical Interventions, Patient Monitoring and Scenarios.**	**Software Control**	**Manual Control**
Airway Management and Ventilation	**Alveolar and arterial gas concentrations appropriately reflect the efficacy of ventilation and oxygen administration.**	None required.	None required.
Arterial Blood Gases	**PaO_2, $PaCO_2$ and pH are continuously calculated and displayed when selected for the Patient Status Display.**	None required, but adjustable VIEW: **Respiratory** PARAMETER(S): **O_2 Consumption, CO_2 Production Factor**	None required.
Breakaway Teeth	**Upper front teeth can be dislodged if laryngoscopy is performed incorrectly.**	None required.	*See Breakaway Teeth, page 178.*
Bronchial Occlusion	**Completely obstructs right and/or left mainstem bronchi, simulating a lower airway obstruction (e.g., mucus plug). This yields an inability to ventilate the lungs.**	VIEW: **Respiratory** PARAMETER(S): **Bronchial Occlusion**	None required.
Chest Excursion	**Synchronized with ventilation (spontaneous or mechanical). Excursion depth proportional to tidal volume.**	None required.	None required.
Chest Tube Placement	**Chest tubes can be inserted bilaterally into the midaxillary line of the fifth intercostal space. Suction equipment can be applied to withdraw fluid from the simulated intrapleural space.**	The instructor must adjust the amount of physiologic intrapleural fluid present. VIEW: **Respiratory** PARAMETER(S): **Chest Tube, Chest Tube Flow, Chest Tube Air Leak**	See *Chest Tube, page 179.*
Cricothyroid Membrane	**Allows needle cricothyrotomy, transtracheal jet ventilation, retrograde wire techniques and cricothyrotomy.**	None required.	*See Cricothyrotomy, page 178.*
Esophagus, Lower Esophageal Sphincter and Stomach	**Esophageal intubation results in gastric distension and the absence of breath sounds, chest excursion and CO_2 output.**	None required.	None required.

Respiratory Features			
Exhaled CO_2	**Measurement of exhaled CO_2.**	None required.	None required.
Laryngospasm	**Closes vocal cords and prevents intubation and ventilation. When used with posterior pharynx swelling, creates a "can't intubate, can't ventilate" scenario.**	VIEW: **Respiratory** PARAMETER(S): **Laryngospasm**	None required.
Needle Decompression	**Decompression of a pneumothorax can be performed bilaterally by inserting a needle at the midclavicular line of the second intercostal space.**	The instructor must adjust the amount of physiologic intrapleural air present. VIEW: **Respiratory** PARAMETER(S): **Needle Decompression, Intrapleural Vol: Left, Intrapleural Vol: Right**	See *Needle Decompression, page 181*.
Posterior Pharynx Swelling	**Limits view of larynx to hinder intubation, but allows mask ventilation, creating a "can't intubate, can ventilate" scenario.**	VIEW: **Respiratory** PARAMETER(S): **Airway Occluder**	None required.
Pulse Oximetry	**Oxyhemoglobin saturation (SpO_2) automatically correlates with the oxygen concentration in the lungs and the intrapulmonary shunt fraction.**	None required, but adjustable VIEW: **Respiratory** PARAMETER(S): **SpO_2, Shunt Fraction**	None required.
Realistic Upper Airway (Oropharynx, Nasopharynx and Larynx)	**Allows direct laryngoscopy, oral and nasal intubation and use of specialty airway devices such as endotracheal tubes, combitubes and oropharyngeal airways.**	None required.	None required.
Spontaneous, Self-Regulating Breathing	**Normal tidal breathing and pathophysiological conditions such as atelectasis, pneumothorax, asthma and COPD.**	None required, but adjustable VIEW: **Respiratory** PARAMETER(S): **Respiratory Rate, Respiratory Rate Factor**	None required.
Symmetric and Asymmetric Lung Ventilation	**Tracheal or endobrachial intubation, pathophysiologic conditions such as pneumothorax.**	None required, but adjustable VIEW: **Respiratory** PARAMETER(S): **Chest Wall Compliance Factor**	None required.

Respiratory Features			
Tongue Swelling (Swollen, Semi-Swollen, Not Swollen)	**Hinders, but does not prevent, intubation.**	VIEW: **Respiratory** PARAMETER(S): **Swollen Tongue**	None required.
Trachea, Left and Right Mainstem Bronchi	**Tracheal intubation results in bilateral chest excursion and breath sounds. Endobronchial intubation results in unilateral chest excursion and breath sounds.**	None required.	None required.
Venous Blood Gases	**PvO_2 and $PvCO_2$ are continuously calculated and displayed when selected for the Patient Status Display.**	None required, but adjustable VIEW: **Respiratory** PARAMETER(S): **$PaCO_2$ Set-point, PaO_2 Set-point, PET CO_2-$PaCO_2$ Factor**	None required.

NOTE: Low **Chest Wall Compliance Factor**, **Distended Chest Wall Compliance Factor** and **Lung Compliance Factor (Left and Right)** settings may result in lung oscillations. If oscillations occur, increase the values of these parameters until oscillations disappear.

NOTE: The optional HPS with Müse SCE Development software can be used on a computer other than the Instructor Workstation to create and run SCEs without being connected to the HPS simulator. When the same SCEs are run on SCE Development Software and on the Instructor Workstation, respiratory responses and vital signs may vary slightly.

Realistic Upper Airway

The upper airway of the HPS is designed to allow for intubation and laryngoscopy. Oral and nasal intubation can be performed using a variety of airway devices, including endotracheal tubes, nasal-pharyngeal airways and oropharyngeal airways. *For supported sizes, see Recommended Clinical Supply Sizes on page 259.*

Intubation incorrectly applied into the esophagus causes abdominal distension.

IMPORTANT: Airways can be damaged by improper insertion of an airway adjunct (e.g., endotracheal tube). To protect the airway, lubricate the adjunct prior to insertion using the silicone spray provided.

Use ONLY the provided SILICONE SPRAY to lubricate the adjunct. NEVER use a water-based lubricant because of resulting residue damage.

Variable Upper/Lower Airway Resistance

Airway interventions can be necessitated and complicated by a number of variables. Located in the Respiratory view are five parameters that affect ventilation and intubation.

Posterior Pharynx Swelling

Swelling of the posterior pharynx can be activated to limit the view of the larynx and hinder intubation, but allow mask ventilation of the patient's lungs, thereby creating a "cannot intubate, can ventilate" scenario.

To activate posterior pharynx swelling, enable the feature using the **Airway Occluder** switch on the Respiratory view.

Laryngospasm

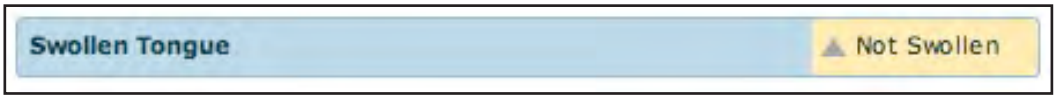
A laryngospasm actuator closes the patient's vocal cords and prevents both ventilation and intubation. When activated along with the **Airway Occluder** parameter, a "cannot ventilate, cannot intubate" crisis scenario is achieved.

The Laryngospasm Switch

To activate laryngospasm, enable the feature using the **Laryngospasm** switch on the Respiratory view.

Tongue Edema (Swelling)

Tongue swelling can be activated to varying degrees (moderate or severe).



Selecting Swollen Tongue

To activate Tongue Swelling, select the **Swollen Tongue** parameter from the Respiratory view and choose either **Swollen** (for severe swelling) or **Semi-swollen**. The Swollen Tongue option is set by default to **Not Swollen**.

Bronchial Occlusion

Bronchial Occlusion completely obstructs the right or left bronchi, simulating a lower airway obstruction (e.g., mucus plug). Improper intubation creates a mainstem occlusion, yielding an inability to ventilate the lungs.

The Bronchial Occlusion Switch

To activate Bronchial Occlusion, enable the feature using the **Bronchial Occlusion (Left or Right)** switch on the Respiratory view.

PEEP

The **PEEP** parameter specifies the amount of positive end expiratory pressure applied during mechanical ventilation. Setting this parameter results in clinically appropriate intrathoracic pressures and hemodynamic responses.

Setting PEEP

After selecting the **PEEP** option from the Respiratory view, use the slider bar or enter an amount to establish the rate of pressure. The **Seconds** or **Minutes** field can also be used to establish an onset time. Once the desired settings have been selected, click **Accept**.

PEEP must be set in both the software and on the ventilator.

Cricothyrotomy

To replicate a needle cricothyrotomy:

1. Spray the silicone lubricant onto the airway adjunct prior to the simulation session.
2. Locate the simulated cricothyroid membrane sealed with tape under the neck skin.
3. Follow standard clinical techniques and palpate to find the cricothyroid space.
4. Puncture the space through the neck skin of the patient simulator and into the tape "membrane." This puncture goes all the way through to the "trachea," simulating the clinical procedure.

Users must replace the tape that simulates the cricothyroid membrane after each cricothyrotomy.

A replacement neck skin, airway lubricant and spools of tape are available in the Replacement Kit.

Replacing the Cricothyrotomy Tape

It is important to replace the red tape that simulates the cricothyroid membrane after each cricothyrotomy procedure. In the Replacement Kit is airway lubricant, a spool of red tape and additional neck skins. Remove the punctured tape and apply a new strip of the red tape, ensuring the opening is completely sealed off. The neck skin only needs to be replaced when it is showing signs of wear.

Resealing the Membrane after a Puncture

To reseal the cricoid feature apply a small piece of red tape over the punctured area. This can be repeated a brief number of times, but when the number of layers impedes the cricothyrotomy, all existing tape must be removed and replaced with new tape.

Breakaway Teeth

The HPS comes with two upper denture plates: one with a complete set of teeth and the other with front Breakaway Teeth that can become dislodged with improper handling of a laryngoscope.

The breakaway denture includes two teeth replacements, one with short attachment posts and the other with longer attachment posts. The shorter posts make the teeth easier to dislodge during intubation.

Chest Tube

A chest tube can be inserted at the midaxillary line of the fifth intercostal space on either side of the simulator. *For supported chest tube size, see Recommended Clinical Supply Sizes on page 259.*

Using ordinary chest tube equipment, fluid and air can be withdrawn from the pleural space. The volume removed influences the patient's physiology to reflect improvement in pulmonary mechanics and gas exchange.

Inserting a Chest Tube

To prime the Chest Tube feature:

1. Fill an empty IV bag with distilled water. Food coloring may be added to the water if desired.
2. Attach the IV solution set to the IV bag, ensuring the clamp is closed.
3. Hang the bag on the back of the HPS Lab Rack.
4. Connect the hose from the IV solution set to the white Trauma hose on the Umbilical Assembly at the back of the HPS Lab Rack.
5. Lubricate the chest tube priming hose in the Replacement Kit with silicone spray.
6. Insert the chest tube priming hose into one of the mannequin chest tube openings as far as possible. The hose must slide in far enough to engage the valve inside the mannequin that leads to the chest tube reservoir.
7. On the Respiratory view, select the **Prime** option under **Chest Tube**.

Setting Chest Tube to Prime

8. Once water begins to flow, select **Disable** under **Chest Tube**.

Setting Chest Tube to Disable

9. Remove the chest tube from the mannequin.
10. Zero the Trauma Flow Meter by pressing the black button on the bottom left corner of the Trauma Flow Meter, located on the back of the HPS Lab Rack.
11. In Müse, set the **Intrapleural Volume: Left**, **Intrapleural Volume: Right**, **Chest Tube Flow** and **Chest Tube Air Leak** (optional) parameters to the desired amounts. These parameters are located on the Respiratory view.
12. Set the **Chest Tube** parameter to **Enable**.

*For information regarding cleanup after using the Chest Tube feature, see **Draining the Chest Tube** on page 253.*

Two parameters allow the user to set air flow and fluid rate as well as to determine the type of air leak:

Chest Tube Air Leak - determines the quantity of air that drains with the chest tube output.

Chest Tube Flow - specifies the rate at which fluid can be removed from the simulated pleural space via a chest tube drainage system.

Both parameters are located on the Respiratory view under Additional Parameters.

The **Intrapleural Volume** parameter allows intrapleural volume to accumulate, for example, as happens during pneumothorax, hydrothorax and hemothorax.

To simulate a pneumothorax, set the intrapleural volume to a value greater than 0 mL. Values above 500 mL reduce the corresponding lung volume significantly. Breath sounds and chest excursion are automatically diminished on the appropriate side due to decreased ventilation of the affected lung.

*For information regarding cleanup after using the Chest Tube feature, see see **Draining the Chest Tube** on page 253.*

Needle Decompression

To set up a Pneumothorax Needle Decompression, enable the feature using the Needle Decompression parameter on the Respiratory screen.

The Needle Decompression Switch

Select **ON/OFF** to activate the feature.

Needle decompression can be performed bilaterally into the small hole located in the midclavicular line of the second intercostal space. Insert a needle until the hissing sound of the valve release is heard. *For supported needle size, see Recommended Clinical Supply Sizes on page 259.*

Performing Needle Decompression

The Intrapleural Volume parameter can be used to allow intrapleural volume to accumulate.

Effective needle decompression immediately reduces the intrapleural volume. The hissing sound stops when intrapleural volume is zero.

Cardiovascular Features

The HPS produces realistic heart sounds and a wide range of pathophysiologic conditions synchronized to the QRS complex of the ECG and audible with a standard stethoscope.

Cardiovascular Features			
Anatomy, Physiology and Clinical Signs	**Clinical Interventions, Patient Monitoring and Scenarios.**	**Software Control**	**Manual Control**
5-Lead ECG	**ECG waveforms can be viewed on a standard monitor and/or on the Patient Status Display. Normal and abnormal cardiac rhythms are linked to patient physiology (e.g., blood pressure, cardiac output).**	None required; specific rhythms can be selected. VIEW: **Cardiovascular** PARAMETER(S): **Cardiac Rhythm**	ECG monitor may be utilized.
Baroreceptor Reflex	**Cardiovascular system automatically compensates for changing hemodynamic conditions.**	None required, but adjustable. VIEW: **Cardiovascular** PARAMETER(S): **Baroreceptor Maximum Pressure, Baroreceptor Minimum Pressure**	None required.
Cardiac Pacing	**A transthoracic cardiac pacemaker can be used with the HPS. Pacing results in appropriate physiological changes in blood pressure and cardiac output.**	The instructor can set the level at which electrical capture and mechanical capture occur. VIEW: **Cardiovascular** PARAMETER(S): **Pacing Current, Pacing Rate, Pacing Capture Threshold**	See *Cardiac Pacing* on *page 190* for cardiac pacing disk locations and instructions.
Cardiac Rhythms	**The desired arrhythmia can be selected.**	The response to clinical intervention must be controlled by the instructor. VIEW: **Cardiovascular** PARAMETER(S): **Cardiac Rhythm**	None required.
Chest Compression	**Effective chest compression results in artificial circulation, cardiac output, central and peripheral blood pressures, palpable pulses, and CO_2 return.**	None required, but adjustable. VIEW: **Cardiovascular** PARAMETER(S): **Chest Compression Efficacy**	None required.

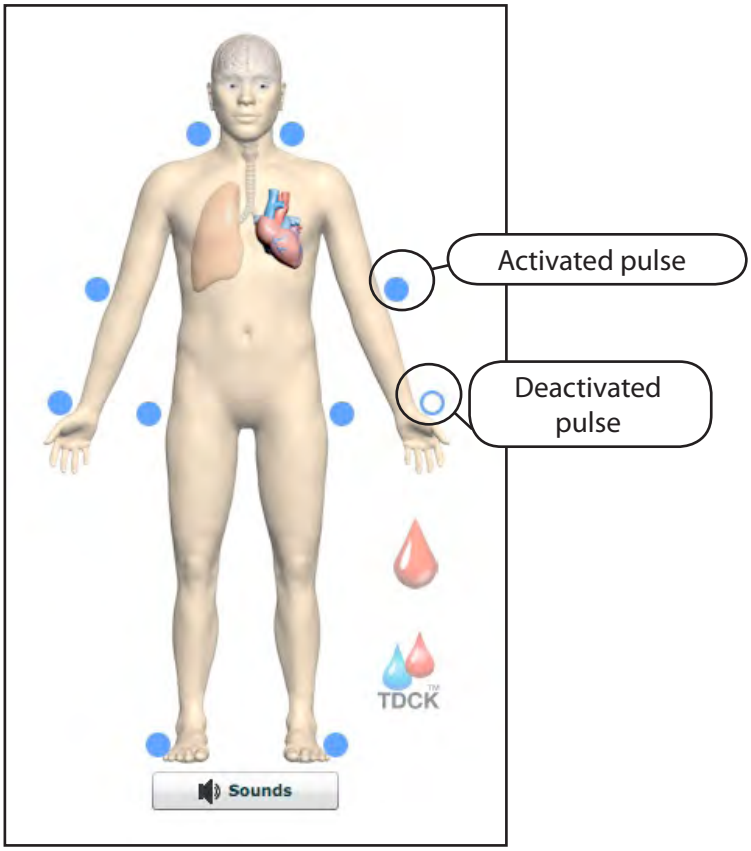
Cardiovascular Features			
Circulation	**Normal and abnormal circulation (e.g., hypovolemia, hypervolemia and right/left heart failure) can be adjusted.**	None required, but adjustable. VIEW: **Cardiovascular** PARAMETER(S): **Systemic Vascular Resistance Factor**	None required.
Defibrillation	**HPS supports operation with a variety of manual and automatic external defibrillators.**	Defibrillation can be simulated by the instructor. VIEW: **Cardiovascular** PARAMETER(S): **Defib**	See *Defibrillation* on *page 190* for defibrillation disk locations and instructions.
Invasive Hemodynamic Monitoring	**Various hemodynamic physiological indicators are registered and can be monitored.**	None required, but adjustable. VIEW: **Cardiovascular** PARAMETER(S): **Arterial Catheter, Central Venous Catheter, PA Catheter**	None required.
Manual Blood Pressure	**Systemic blood pressure can be measured using the return-to-flow technique. Korotkoff sounds can also be auscultated.**	None required.	Use of modified blood pressure cuff.
Myocardial Ischemia	**Myocardial oxygen supply and demand automatically influence the cardiac rhythm, yielding response to hypoxemia.**	None required, but adjustable. VIEW: **Cardiovascular** PARAMETER(S): **Ischemic Index Sensitivity, Ischemic Index Averaging**	None required.
Pericardiocentesis	**Subxyphoid pericardiocentesis can be performed to resolve acute cardiac tamponade.**	The instructor must adjust the amount of physiologic pericardial fluid present. VIEW: **Cardiovascular** PARAMETER(S): **Tamponade Volume**	See *Pericardiocentesis*, *page 191*.
Palpable Pulses	**Carotid, brachial, radial, femoral, popliteal and pedal pulses can be palpated bilaterally and are synchronous with the cardiac cycle. A pulse deficit automatically occurs if the systolic arterial blood pressure falls below specified thresholds.**	None required, but adjustable. VIEW: **All**	None required.

Pulses

The HPS has 12 palpable pulses:

- Carotid (2)
- Brachial (2)
- Radial (2)
- Femoral (2)
- Popliteal (2)
- Pedal (2)

Pulses are visible and can be controlled from any physiological view. All pulses, unless altered by an SCE, are enabled by default. To disable a pulse, click the pulse location on the human form. To enable a pulse, click the pulse location again.



Pulses – Active and Inactive

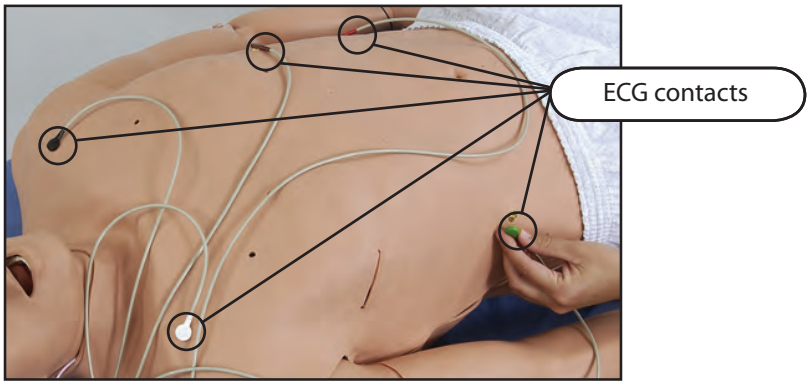
A pulse deficit occurs when the systolic arterial blood pressure falls below the threshold indicated in the table below.

Palpable Pulse Thresholds	
Carotid	**60mmHg**
Brachial	**80mmHg**
Radial	**90mmHg**
Femoral	**70mmHg**
Popliteal/Pedal	**80mmHg**

Click and hold a pulse location to access a window to change the pulse deficit.

5-Lead ECG

A 5-lead ECG is emitted from the appropriate positions for display on a standard monitor. A contact is available on the HPS mannequin's chest for each of five cables.



ECG Contacts

The simulator generates a normal sinus ECG, as well as a broad range of abnormalities such as myocardial ischemia, sinus tachycardia and bradycardia, ventricular fibrillation and asystole. The hemodynamic response to the arrhythmias is physiologically correct. Myocardial oxygen balance and cardiac ischemia automatically influence the cardiac rhythm, resulting in a realistic and automatic response of the rhythm to hypoxemia. The degree of influence can be controlled or completely overridden by the instructor.

Myocardial Ischemia

The cardiac rhythm can be set using the **Cardiac Rhythm** parameter located on the Cardiovascular view.

In addition, the **Ischemic Index Sensitivity**, located under the Additional parameters on the Cardiovascular view, can be used to set the relative sensitivity of the patient to myocardial ischemia.

The lower the value the patient has, the less sensitive the patient is to poor oxygenation and the less likely the patient is to go into a "death spiral."

The **Ischemic Index Averaging** parameter, also located under the Additional parameters on the Cardiovascular view, determines how quickly myocardial ischemia develops in the presence of an unfavorable oxygen supply/demand ratio or how rapidly it resolves when myocardial oxygenation becomes favorable.

For additional information on the Ischemic Index, refer to Appendix D - The Ischemic Index (Death Spiral).

Manual Blood Pressure

Blood pressure can be taken manually on the left arm.

Non-invasive blood pressure monitoring techniques can be used by attaching the standard cuff modified with a T-fitting and adapters.

To modify a standard cuff for use with the HPS mannequin:

1. Take a standard cuff and cut the hose that connects to the pressure gauge.

Cutting the Hose

2. Insert one of the supplied adapter fittings into each of the open ends of the hose. Use a female fitting on one end and a male fitting on the remaining end.

Inserting the Adapters

3. Insert the T-fitting into the hose adapters.

Inserting the T-fitting

4. Connect the remaining portion of the T-fitting to the hose under the left shoulder of the mannequin.

Connecting to Mannequin

Non-invasive blood pressure may now be taken using the return-to-flow technique

NOTE: The NIBP monitor interface supports systolic readings of 67 to 200 mmHg, diastolic pressure readings of 42 to 175 mmHg and pulse pressure readings of 25 mmHg and above.

Store the modified blood pressure cuff with the HPS system.

Korotkoff Sounds (Five Phases)

Korotkoff sounds can be auscultated on the left arm.

To auscultate Korotkoff sounds:

1. Place the stethoscope on the left arm, just above the brachial pulse.
2. Let the cuff pressure drop slowly by opening the valve on the bulb slightly.
3. Monitor the pressure displayed on the cuff gauge.

All five phases should be recognized:

Phase I - Clear, repetitive, tapping sounds (Systolic)

Phase II - Longer beats, with some swishing sounds

Phase III - Crisp, more intense rhythm sounds

Phase IV - Muffled, less distinct sounds

Phase V - Sounds disappear completely (Diastolic)

Defibrillation

The HPS is designed to safely absorb the energy discharged from manual and automatic defibrillators. Standard defibrillation energy levels should be used for positive learning reinforcement and to avoid negative training transfer.

However, use of a defibrillator for training purposes represents an operational hazard equivalent to use of a defibrillator on a real patient. Consequently, ALL SAFETY PRECAUTIONS for the use of defibrillators MUST BE FOLLOWED as if the simulator were a patient. Consult the specific defibrillator's user manual for further information.

The following cautions should be observed:

Defibrillation should be performed on the defibrillation electrodes only. If defibrillation is performed over any ECG electrode, high voltage may be present on the remaining connectors during the shock. This may also damage ECG circuitry.

To prevent overheating, DO NOT provide more than three (3) defibrillation discharges in a sequence per minute during the training session (maximum 360 joules with a monophasic defibrillator). Avoid a large number of consecutive discharges. For example, 20 or 25 discharges without any recovery interval may damage the system. Leave at least 20 minutes recovery period after a sequence of more than 10 consecutive discharges.

Avoid a large number of consecutive discharges. For example, 20 or 25 discharges without any recovery interval may damage the system.

Do NOT let the simulator come in contact with electrically conductive surfaces or objects during defibrillation. A flame-supporting atmosphere, for example, with a high content of oxygen, should be avoided during defibrillation.

Keep the simulator chest dry. Special attention should be taken when using the urinary system or the chest tube feature.

To prevent pitting of the chest skin electrode, do NOT apply conductive gel or conductive defibrillation pads intended for patient use.

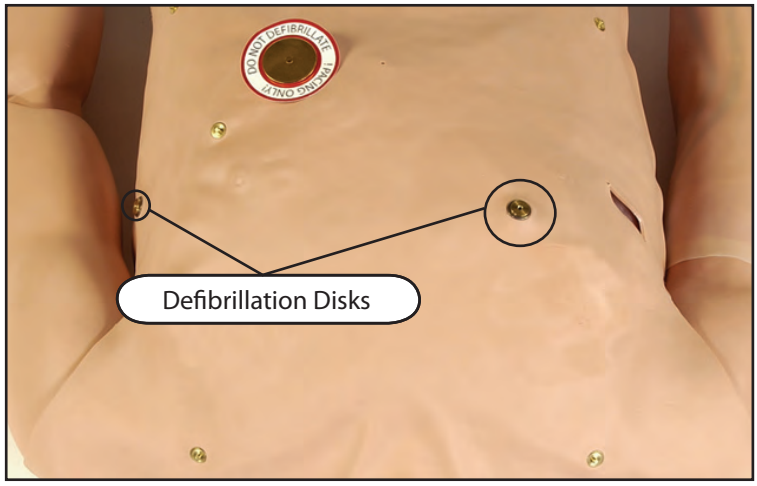
Do NOT use cables or connectors having visible damage.

Do NOT spill fluids over any component inside the simulator torso. This could damage the system and may also present a possible hazard for the operator.

When using a manual defibrillator, the ECG can be monitored via the defibrillator paddles. Coarse ventricular fibrillation and high-rate ventricular tachycardia cardiac rhythms are automatically recognized as "shockable" rhythms.

With each defibrillation, the HPS automatically records the amount of energy discharged and the time defibrillation was performed. The simulated patient response to defibrillation is determined by the scenario script or instructor intervention. Thus, cardioversion is not automatically determined by the physiological models.

For paddle placement on the chest, the simulator has two anterior defibrillation disks, which can be unscrewed leaving threaded connections if required.



Defibrillation Disks

Monophasic defibrillators can be used with paddles or hands-free connectors.

The **Defib** parameter is available for virtual defibrillation. The Defibrillation parameter is located on the Cardiovascular view.

Cardiac Pacing

A standard transthoracic cardiac pacemaker can be connected to the simulator using the anterior and posterior contacts. To use this feature, attach the metal defibrillation/pacing disks to the contacts by screwing them into place. Once the disks are in place, attach the pacing pads from a standard transthoracic cardiac pacer to the mannequin at the site of the disks. The software will automatically detect and respond to pacing signals.

Three parameters can be used to simulate pacing within the software:

Pacing Capture Threshold - determines the minimum pacing current necessary to pace the heart

Pacing Current - simulates a specific amount of current discharged by an external cardiac pacemaker

Pacing Rate - determines the cardiac rate when the Pacing Current is at or above the Pacing Capture Threshold

All three parameters are located on the Cardiovascular view.

Pericardiocentesis

The pericardiocentesis feature must be primed prior to use.

To prime the system for pericardiocentesis:

1. Fill an empty IV bag with distilled water. Food coloring may be added to the water if desired.
2. Attach the IV solution set to the IV bag, ensuring the clamp is closed.
3. Hang the bag on the back of the HPS Lab Rack.
4. Connect the hose from the IV solution set to the white Trauma hose on the Umbilical Assembly at the back of the HPS Lab Rack.
5. In Müse, go to the Cardiovascular view. *For information on how to access the Cardiovascular view, see **Using the Physiological Views** on page 66.*
6. Set the **Pericardiocentesis Enable** parameter to (**Prime**).
7. Insert a needle with a 20 mL syringe into the pericardiocentesis access port located near the xiphoid process of the mannequin. *For supported needle size, see Recommended Clinicnal Supply Sizes on page 259.*
8. Draw back until fluid flows into the syringe.
9. Set the **Pericardiocentesis Enable** parameter to **Enabled**.

*For information on cleanup after using the Pericardiocentesis feature, see **Draining the Pericardiocentesis Feature** on page 254.*

Fluids

Many HPS fluids, such as IV Fluid Administration and Urinary Output, can be managed from the Fluids view.

Fluids			
Anatomy, Physiology and Clinical Signs	**Clinical Interventions, Patient Monitoring and Scenarios.**	**Software Control**	**Manual Control**
IV Access	**The right arm of the simulator provides intravenous access locations at the brachial, cephalic, antecubital and basilic veins. IV cannulations receive a flash.**	None required.	See *IV Access* on *page 201*.
IV Medication Administration	**Bolus injections are administered utilizing standard syringes while continuous IV infusions can be administered using infusion devices. Injections can be administered in the IV arm or in two permanent access catheters located at the right jugular and left femoral veins.**	None required if using Drug Recognition. If not using drug recognition, administered IV medications must be set by the instructor. Medications are administered via the Medications and Interventions palettes.	All administered IV medications are collected in the bag attached to the **DRUG REC OUT** hose located on the back of the HPS Lab Rack.
IV Fluid Administration	**IV fluids can be administered in the IV arm or in the two permanent access catheters located at the right jugular and left femoral veins.**	None required if using Drug Recognition. If not using Drug Recognition, administered IV fluids must be set by the instructor. VIEW: **Fluids** PARAMETER(S): **Colloid Infusion, Crystalliod Infusion, PRBC Infusion, Whole Blood Infusion** *IV fluid administration can also be achieved by using the Intervention palettes.*	All administered IV medications are collected in the bag attached to the **DRUG REC OUT** hose located on the back of the HPS Lab Rack.
Urinary Output	**Urinary output can be controlled by the instructor.**	VIEW: **Fluids** PARAMETER(S): **Urinary Output**	See *Genitourinary System* on *page 195*.

Circulation

Circulation can be affected by blood or plasma loss, fluid infusion or changes to the contractility of the left or right ventricles.

Controlling Fluids

The Fluids view contains six parameters that affect circulation.

Fluid Parameters Affecting Circulation	
Fluid Event	**Use/Effect**
Fluid Loss Blood	Reflects a decrease in total blood volume. "Blood Loss" proportionally decreases both the red blood cell volume and the plasma volume according to the current hematocrit.
Fluid Loss Plasma	Reflects a decrease in plasma volume. "Fluid Loss" decreases the plasma volume without changing the red blood cell volume. It refers collectively and generically to all fluid losses, including evaporative, transcellular (e.g., ascites, pleural effusion), bowel and third space fluid losses.
Colloid Infusion	Reflects an addition to the plasma volume without changing the red blood cell volume. Colloids include modified fluid gelatin starch solutions (pentastarch and hetastarch), dextran and human albumin.
Crystalloid Infusion	Reflects an addition to the plasma volume without changing the red blood cell volume. The term crystalloid is used to describe salt solutions for infusion, for example, normal saline, dextrose in water and Ringer's Lactate.
Packed Red Blood Cells (PRBC) Infusion	A preparation of 70% red blood cells and 30% liquid plasma, often administered in severe anemia to restore adequate levels of hemoglobin and red cells without overloading the vascular system with excess fluids.
Whole Blood Infusion	The term "whole blood" is used to refer to blood that has not been separated into its various components. It represents a preparation of 40% red blood cells and 60% liquid plasma.

To control fluids lost or infused, select the desired fluid parameter from the Fluids view. The amount of fluid to be lost or infused and the time frame during which the fluid loss or infusion takes place can be entered.

Hematology Model

The physiological model calculates hematocrit values (i.e., percentage of total blood hemoglobin) dynamically and continuously, taking into account blood and fluid losses, as well as the intravenous infusion of fluids such as whole blood, packed red blood cells, colloids and crystalloids.

Instructors can create patients with both normal and pathophysiological hematocrit levels. In addition, learners discover how administering various fluids affects hematocrit, the oxygen-carrying capacity of blood, and the resulting patient response.

The following important assumptions were made in the design of the Hematology Model:

Blood is comprised of two components: red blood cells and plasma.

Plasma is comprised of two components: colloid and crystalloid. The term colloid is used to describe substances that generate a clinically significant colloid osmotic pressure, for example, fresh frozen plasma, albumin and hetastarch. The term "crystalloid" is used to describe salt solutions for infusion, for example, normal saline, dextrose in water and Ringer's Lactate.

The mixing of blood and its various constituents is instantaneous and homogeneous. In other words, one liter of crystalloid administered intravenously equilibrates immediately and homogeneously throughout the entire circulation.

This initial Hematology Model does not yet distinguish between the differing clinical effects of colloids versus crystalloids. For example, osmotic pressures and capillary leakage rates are not taken into account. Likewise, fluid kinetics and how fluids distribute within the circulation, the interstitial, and intracellular spaces are also not presently modeled.

In the Hematology Model, the following model variables, definitions and relationships have been established:

Red Blood Cell Volume: The volume of red blood cells within the circulation.

Plasma Volume: The volume of plasma within the circulation.

Total Blood Volume: The volume of blood (i.e., Red Blood Cell Volume + Plasma Volume) within the circulation.

Blood Volume Loss: The amount or rate of decrease in the total blood volume. A given amount or rate of blood loss proportionally decreases both the Red Blood Cell Volume and the Plasma Volume according to the current hematocrit.

Plasma Volume Loss: The amount or rate of decrease in the plasma volume. A given amount or rate of plasma loss decreases the plasma volume without changing the red blood cell volume. Plasma Volume Loss refers collectively and generically to all plasma fluid losses, including evaporative, transcellular (e.g., ascites, pleural effusion), bowel and third space losses.

Hematocrit: The ratio of Red Blood Cell Volume to Total Blood Volume, expressed as a percentage.

Genitourinary System

The simulator comes with interchangeable male and female genitalia and allows for the insertion of urinary catheters and excretion of urine with a flow rate that is controlled by the instructor.

Setting Up Fluid for Use with the Genitourinary (GU) System

1. Attach the desired genitalia (male or female) to the mannequin.
2. Hang a bag of distilled water on one of the available hooks on the back side of the HPS Lab Rack.
3. To simulate urine, add 1.5 to 2 mL of yellow food coloring to the water.
4. Add an IV solution set to the bag, placing the roller clamp in the locked position.
5. Open the hood casing on the GU Pump, pulling the attachment lever down and lifting the hood up.

Opening the Hood Casing

6. Slide the supplied peristaltic tubing over the wheel. The end with the quick connector should be on the left side of the wheel and the end with the luer connector should be on the right side of the wheel.

The GU Tubing

7. Close the hood and re-secure the lever in the up position.

Closing the Hood Casing

8. Pull open the black clips on each side of the GU Pump and carefully thread the tubing into place. Start with the right side and repeat on the left.

Right GU Pump Clip

Left GU Pump Clip

9. Attach the GU hose from the Umbilical Assembly to the GU tubing.

Attaching the GU Hose

10. Connect the remaining end of the peristaltic tubing to the IV bag.

Connecting the Peristaltic Tubing to the IV Bag

Priming the GU System

1. Catheterize the patient mannequin using a urinary catheter lubricated with silicone spray using standard clinical procedure. *For supported catheter size, see Recommended Clinical Supply Sizes on page 259.*
2. Open the roller clamp on the GU supply source bag.
3. Turn on the urinary output by selecting Fluids view in Müse, then setting the **Urinary Output** value to the maximum level (500 mL/hr). *For information on how to access the Fluids view, see **Using the Physiological Views** on page 66.*

   Fluid flows into the mannequin, filling the reservoir.
4. Once the reservoir is full, turn off the urinary output in the software and remove the catheter.

Urinary Catheterization

1. Catheterize the simulator using a standard urinary catheter lubricated with silicone spray. *For supported catheter size, see Recommended Clinical Supply Sizes on page 259.*
2. Attach a urine collection bag to the urinary catheter.
3. Use the Müse software to set the desired urinary output.

Urinary Output

Urinary output can be controlled by adjusting the **Urinary Output** parameter on the Fluids view.

Selecting Urinary Output

Pharmacology System

The HPS supports pharmacological interventions through pre-programmed pharmacokinetic and pharmacodynamic parameters that are established for more than 50 intravenous drugs.

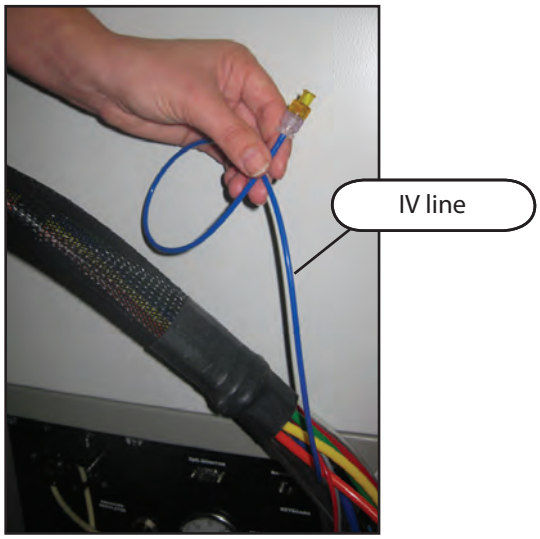
Standard syringes and infusion devices can be utilized to administer medications and fluids through veins on the left and right arms.

Additionally, medications and fluids can be administered through the permanent access catheters located at the right jugular and the left femoral veins.

Priming the IV System

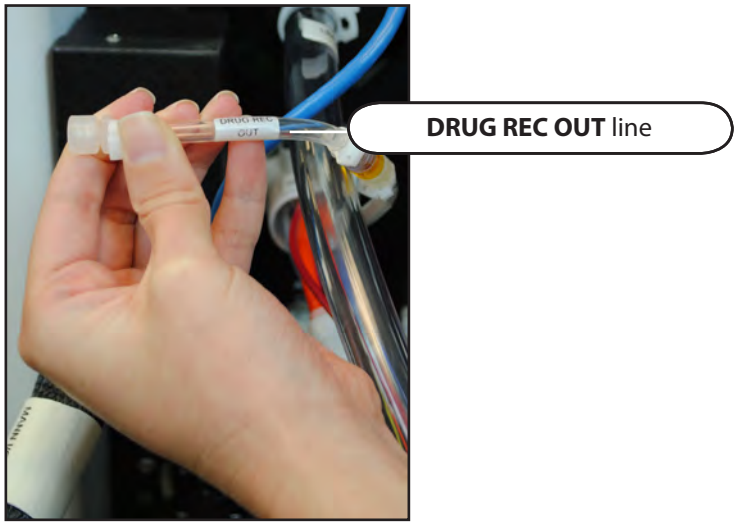
The IV system should be primed prior to use. To prime the IV system:

1. Hang an IV source bag filled with distilled water. A small amount of red food coloring may be added to the water to simulate blood.
2. Attach an IV solution set to the source bag and close the clamp.
3. Attach the IV tubing from the IV solution set to the small blue IV line located at the end of the fluid umbilicus that extends from the mannequin.



IV Line

4. Attach an empty IV drain bag to the **DRUG REC OUT** line of the Pneumatic Left umbilicus on the back of the HPS Lab Rack.



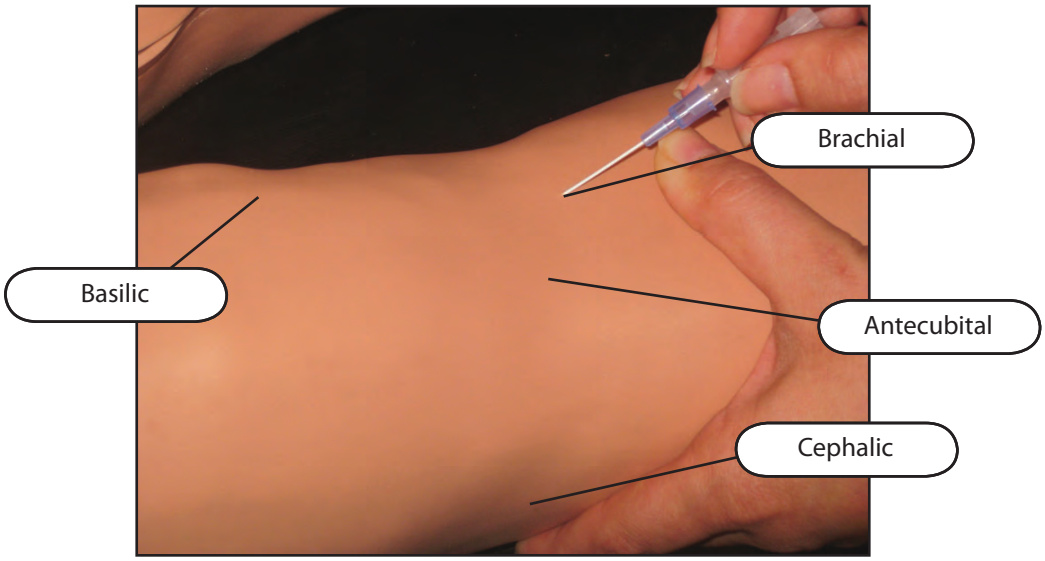
Drug Rec Out Tube

5. Unclamp the IV solution set attached to the source bag, allowing the water to flow into the mannequin and prime the veins.
6. The mannequin is fully primed when liquid flows into the IV drain bag with no air bubbles.
7. Once the mannequin is primed, clamp the IV source bag to stop the flow of liquid into the mannequin.

IV Access

Once the system is primed, the right arm veins can be cannulated with standard venous access needles and catheters. Brachial, cephalic, basilic and antecubital region veins are available. IV cannulations receive a flash when the mannequin's veins are primed.

WARNING: If a flash does NOT occur, do NOT inject any fluid and remove the needle immediately. Repeat the priming directions and ensure you have injected the needle properly and into the simulated vein.



IV Access

Smaller needles are recommended to extend the life of the plumbing inside the mannequin. Forcing fluids with the syringe technique through the IV source hose is not recommended, as this can weaken the internal tubing.

Permanent IV Access Ports

Permanent IV access ports are available at the right jugular and left femoral veins.

*For information on cleanup after using the IV feature, refer to **Maintaining the IV System** on page 255.*

Gastrointestinal Features

The HPS allows for diagnostic peritoneal lavage.

Gastrointestinal Features			
Anatomy, Physiology and Clinical Signs	**Clinical Interventions, Patient Monitoring and Scenarios.**	**Software Control**	**Manual Control**
Diagnostic Peritoneal Lavage	**Diagnostic peritoneal lavage can be performed by inserting a needle into the peritoneum.**	None required.	See *Diagnostic Peritoneal Lavage* on *page 202*.

Diagnostic Peritoneal Lavage

Diagnostic peritoneal lavage can be performed on the HPS mannequin using the Diagnostic Peritoneal Lavage abdominal cavity.

To prepare the mannequin for diagnostic peritoneal lavage:

1. Carefully pull back the chest skin just enough to expose the abdominal area. Do not lift the chest skin more than 6 to 9 inches above the chest plate, as doing so may damage the ECG wires.

   IMPORTANT: Be sure not to snag any of the ECG lead wires on the chest plate.

2. Ensure the Diagnostic Peritoneal Lavage abdominal cavity is inserted in the abdomen area of the HPS mannequin. The cavity is a removable lobe with a small fluid reservoir. A slit sealed with red tape in the lower portion of the cavity leads to the reservoir.
3. Remove the red tape covering the slit in the cavity.
4. Using a syringe, push the desired amount of distilled water (tinted with food coloring if desired) directly into the Diagnostic Peritoneal Lavage abdominal cavity. The cavity holds up to one liter of fluid.
5. Reseal the tape over the slit in the cavity, ensuring the tape is sealed well.

Sounds

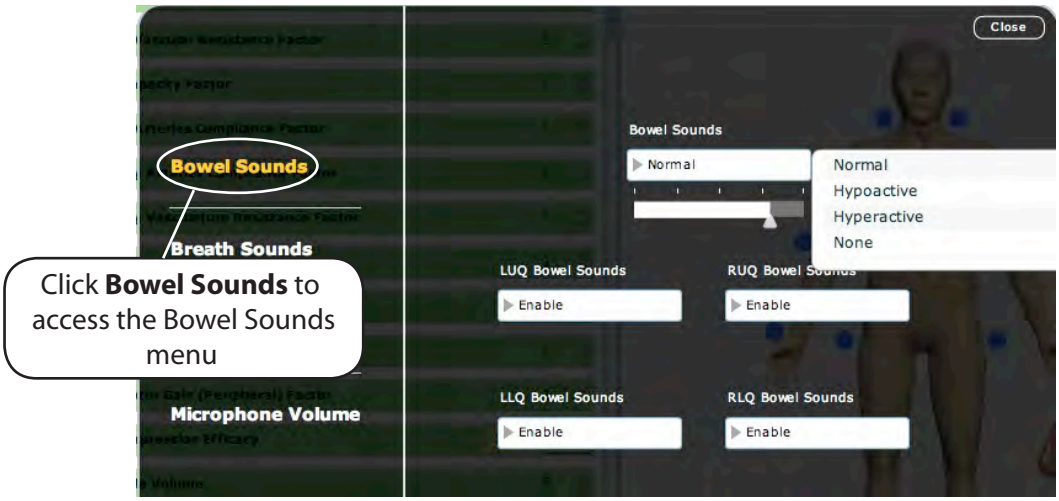
A variety of simulated sounds are available to enhance realism. A patient must be running on the HPS for any sounds to be available.

Bowel Sounds

Learners can auscultate bowel sounds over each of four intestinal quadrants: the Upper Right, Upper Left, Lower Right and Lower Left. The sounds can be independently set in each anatomical region to Normal, Hypoactive, Hyperactive or None (bowel sounds are absent).

Bowel Sounds
Normal
Hypoactive
Hyperactive
None

Bowel sounds can be adjusted by clicking the **Sounds** button on the Run screen. When the Sounds panel appears, select **Bowel Sounds**.



The Bowel Sounds Menu

Click any one of the Bowel Sounds drop-down menus that each control one of four quadrants to change the type of sound.

Click and drag the slider below the **Bowel Sounds** drop-down menu to adjust the volume.

Normal bowel sounds are present by default.

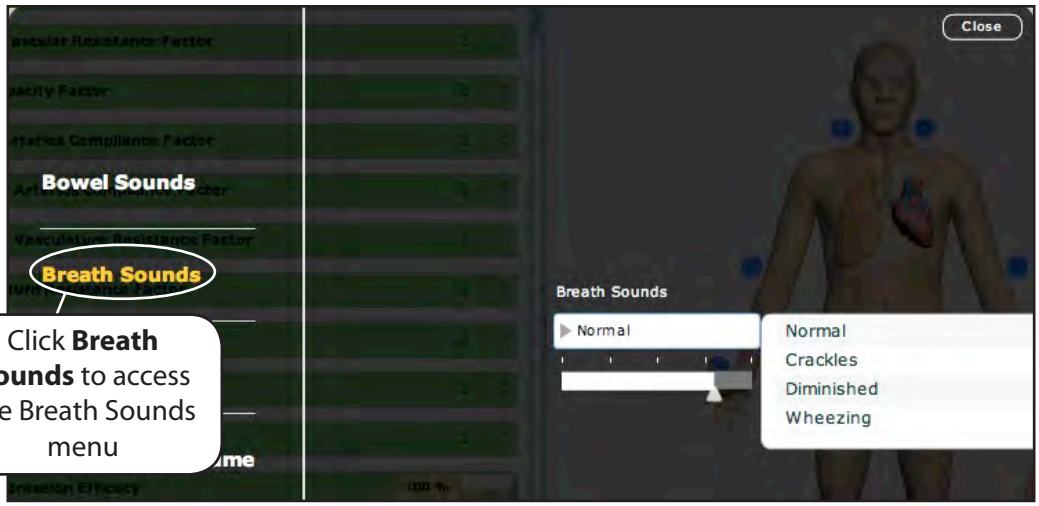
NOTE: If your simulator is not capable if simulating bowel sounds, hide the bowel sounds functionality in Müse prior to logging into the software. To hide bowel sounds, in the upper right corner of the Müse Start screen, select the **Simulator Features** link, then ensure the box next to **Bowel Sounds** is unchecked.

Breath Sounds

Breath sounds are independently synchronized with ventilation of the left and right lungs. Breath sounds can be auscultated over the apex, axilla and posterior anatomic locations.

Breath Sounds
Normal
Crackles
Diminished
Wheezing

Breath sounds can be adjusted by clicking the Sounds button on the Run screen. When the Sounds panel appears, select **Breath Sounds**.



The Breath Sounds Menu

Click the **Breath Sounds** drop-down menu to change the type of sound. Click and drag the slider to adjust the volume.

By default, Normal breath sounds are heard.

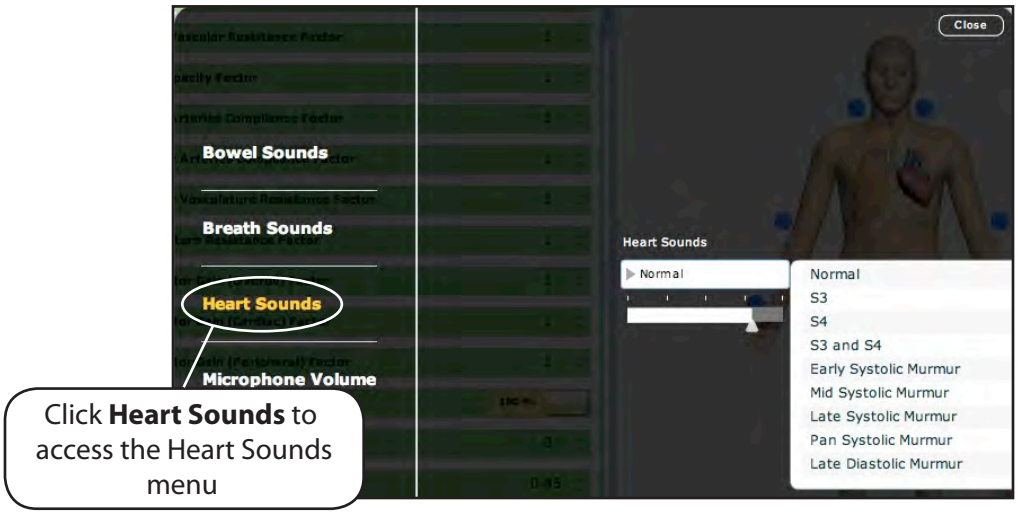
Heart Sounds

Heart sounds are synchronized with the QRS complex of the ECG. Heart sounds can be auscultated over the left and right sternal border, right lower sternal border and apex.

By default, heart sounds are set to **Normal**. The following sounds are available:

Heart Sounds
Normal
S3
S4
S3 and S4
Early Systolic Murmur
Mid Systolic Murmur
Late Systolic Murmur
Pan Systolic Murmur
Late Diastolic Murmur

Heart sounds can be adjusted by clicking the **Sounds** button on the Run screen. When the Sounds panel appears, select **Heart Sounds**.



The Heart Sounds Menu

Click the Heart Sounds drop-down menu to change the type of sound. Click and drag the slider to adjust the volume.

Wireless Voice Capability

Patient responses can be transmitted through the HPS head speaker using the wireless microphone.

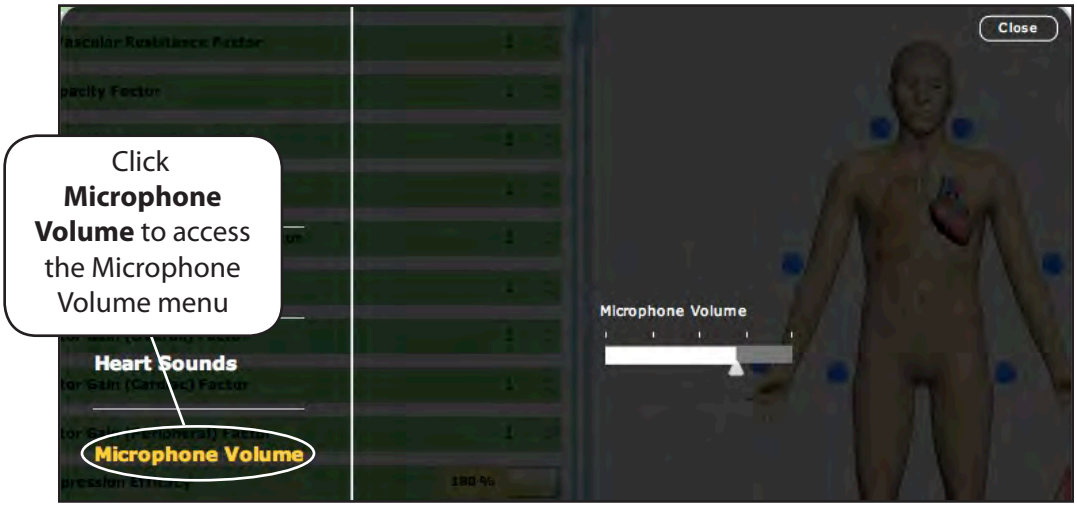
The wireless microphone and receiver are factory-configured to use the same channel (frequency). However, if using multiple simulators, the wireless microphone and receiver channels must be adjusted so each simulator uses a different channel.

For each simulator, adjust the wireless microphone channel, then remove the front panel of the HPS lab rack and set the receiver to the same channel. The wireless microphone and receiver for the same simulator MUST be set to the same channel for proper operation.

Wireless Receiver and Microphone

The microphone volume can be adjusted on the microphone itself using the volume control.

The microphone volume can also be adjusted by clicking the Sounds button on the Run screen. When the Sounds panel appears, select **Microphone Volume**. Click and drag the slider to adjust the volume.



The Microphone Volume Menu

Drug Recognition

The HPS Drug Recognition System enhances the learning process by realistically representing the injection of intravenous drugs during simulation. Standard syringes are labeled with drug types, concentrations and barcodes. Each syringe can be filled with distilled water and injected into the mannequin through a specially configured Stopcock Manifold. As the bolus is injected via the manifold, the Drug Recognition System's barcode reader automatically identifies the drug and its concentration, and a syringe pump mechanism measures the dose. The drug concentration and dose information are automatically transmitted to the HPS6 software, which simulates the appropriate physiological response.

The components of the Drug Recognition system are described below.

Labels

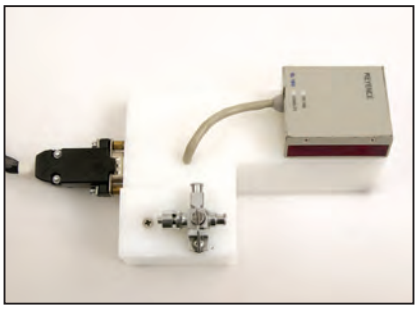
Labels representing a wide range of drugs are supplied with the HPS. The barcode on each label identifies the drug and concentration to the HPS system. The labels should be applied to 10 mL, 20 mL, or 50 mL syringes, with the barcode oriented toward the needle end of the syringe and the graduations on the syringe still visible. This way, when the syringe is inserted into the stopcock with the graduations facing upward, the barcode faces the scanner and can be automatically read.

Syringes and Labels

Store the labels and labeled syringes in a dry location to extend their usability. Over time, they show signs of wear. Contact CAE Healthcare for replacements as needed.

Stopcock Manifold

The Stopcock Manifold is the system to which the stopcock and barcode reader are mounted. The stopcock serves as the injection site for boluses administered through the Drug Recognition System, and the barcode reader is the mechanism used to identify drugs administered. Drug data read by the barcode reader is communicated from the Stopcock Manifold to the HPS Rack via an electrical cable connected to the back of the rack.



Stopcock Manifold

IV Bag and Stake Set

A standard IV bag and stake set are used to prime the Drug Recognition System with distilled water and keep it primed throughout a simulator exercise. These items are user-supplied.

IV Bag and Stake Set

IV Access Ports

The HPS mannequin is equipped with two preconfigured IV access sites at the right jugular and left femoral veins. Each site can be attached to the Stopcock Manifold for easy drug administration. Through these access sites, drugs can be injected into the mannequin and measured by the Drug Recognition System's syringe pump mechanism.

NOTE: Check valves are attached to the access sites to prevent leaks while the manifold is disconnected. Caps for the unused sites are also included as a further precaution. Spare caps and check valves are included with the Drug Recognition System. Contact CAE Healthcare for replacements.

Drug Recognition Syringe Pump Mechanism

The Drug Recognition System's syringe pump mechanism is located inside the anesthesia delivery system access panel at the top of the HPS rack. It measures the flow rate of the injected bolus, which is used to calculate the dose administered.

Drug Recognition Circuit Board

The Drug Recognition Circuit Board controls the entire Drug Recognition System and calculates the administered dose using information from the other system components. Once the dosage is calculated, the circuit board communicates this information to the software, which drives the appropriate physiological response. The Drug Recognition Circuit Board is located on the drug recognition panel on the back of the rack.

Fluid Reservoir

The water that is injected into the Drug Recognition System is collected in a user-supplied second IV bag and stake set as it flows from the Drug Recognition syringe pump mechanism. This IV bag and stake set should lie on the floor during a learning session.

Fluid Reservoir

Setup

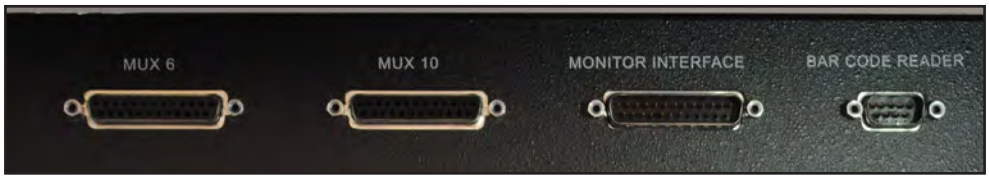
Complete the following steps to set up the Drug Recognition System:

Ensure the HPS Lab Rack is powered on, with the umbilical assembly connected and gas supplies connected and activated. *(Refer **HPS with Müse Setup** on page 25 of this User Guide for complete instructions.)*

1. Gather the components of the Drug Recognition System, including the Stopcock Manifold, bag of distilled water, empty IV bag, two IV stake sets and barcodes and syringes.

Drug Recognition Inventory

2. Secure the electrical connection on the Stopcock Manifold to the **BAR CODE READER** serial port on the back of the HPS Lab rack, firmly tightening the screws.



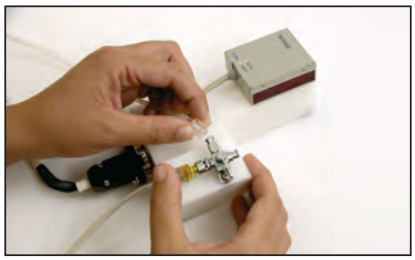
The Bar Code Reader Serial Port

3. With the manifold oriented so the barcode reader is to your right and the stopcock mechanism is to your left, attach one of the IV access site lines labeled **DRUG REC IN** to the Stopcock Manifold at the nine o'clock position. Confirm that the valve is properly in place.

Attaching the IV Access Line

4. Verify that check valves and caps on unused IV access sites are in place. The check valves and caps prevent leakage during the simulation session.

5. Attach an empty IV bag and stake set to the **DRUG REC OUT** port on the Left Pneumatic Umbilical connector on the rear panel of the HPS rack. Ensure the clamp on the stake set is open.
6. Place the IV bag on the floor. This serves as the fluid reservoir.
7. Fill an IV bag with distilled water.
8. Insert an IV stake set, making sure the roller clamp is closed.
9. Secure the open end of the IV stake set on the full IV bag to the Stopcock Manifold port located at the twelve o'clock position.



Attaching the Full IV Bag

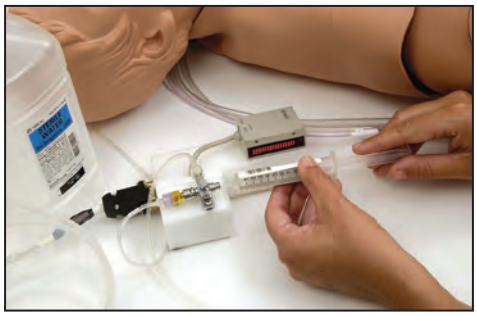
10. Place the stopcock lever in the six o'clock position.
11. To prime the port, open the roller clamp on the IV source bag and allow the fluid to fill up the IV line.

The Drug Recognition System is now ready for use. Note that the system does not accurately register doses unless it is properly primed. A test dose can be administered to confirm proper operation by using the Operation steps. Compare the dose dispensed with the dose displayed in the Events Log. If the registered dose is inaccurate, repeat the priming procedures.

Operation

Once setup is complete, a bolus dose of any drug included in the Drug Recognition Barcode sheets can be administered using the steps outlined below.

1. Ensure the entire HPS system is connected and powered on and the Müse software is connected to the mannequin. *(Refer **HPS with Müse Setup** on page 25 of this User Guide for complete instructions.)*
2. Fill the desired labeled syringe with distilled water. Make sure no air remains in the syringe and the plunger is aligned exactly with the correct graduation on the syringe.
3. Insert the syringe into the Stopcock Manifold at the three o'clock position. The port into which the syringe is inserted should be the only open port on the Stopcock Manifold. The barcode on the syringe should be oriented parallel to the LED side of the barcode reader.

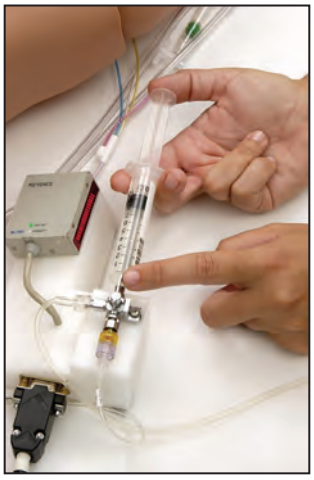


Inserting the Syringe

4. Confirm that the barcode reader is scanning the syringe by observing the small green LED light on the top of the reader case. It blinks when the barcode is read. The red barcode reader light also indicates a reading and blinks rapidly while scanning a syringe.

Indicator Lights

5. Open the stopcock lever to the three o'clock position and inject the syringe. Gradually depress the syringe's plunger to dispense the desired dose.



Injecting the Syringe

6. For optimal accuracy, pause for about one second.
7. Return the stopcock lever to the **OFF** or six o'clock position.

   An audible beep from the HPS Lab Rack confirms that the dose has been recognized by the system.

   The drug type, concentration and dose are displayed in the Müse Events Log.

8. Remove the syringe from the Stopcock Manifold.

Troubleshooting the Stopcock

If the Drug Recognition System is not working as expected, examine the underside of the metal stopcock platform for buildup or corrosion and remove any debris with a soft cloth.

Always check the placement of the lever on the stopcock prior to drug administration. Make sure it is in the **OFF** or six o'clock position when not in use.

To stop an infusion, choose the appropriate drug under the **Medications** menu and select a 0 infusion option (e.g., 0 mg/kg/min, 0 mcg/min).

Cleanup

After using the Drug Recognition System in a simulator exercise, it must be flushed and purged. Complete the following steps to ensure proper performance of the system during subsequent simulator exercises:

1. Flush the system with one liter of distilled water.
   a. Ensure the IV reservoir bag in the rear of the HPS rack has enough room to hold one additional liter of fluid.
   b. Replace the IV supply with a 1 liter IV bag of distilled water.
   c. Prime the bulb of the IV stake and ensure that flow has started.
   d. Allow the water to flow until the bag is empty.
2. Close the clamps on both the IV supply and the reservoir.
3. Remove the IV bags from the stake sets and drain them appropriately.
4. With a large syringe, flush the IV port with air (as though dispensing a bolus of air) until all water is dissipated.

   IMPORTANT: The system must be cleaned after each use to prevent damage.

   IMPORTANT: The system must be cleaned in the prescribed way to prevent damage to the flowmeter.

5. To prevent mold, mildew and fungus from growing in the Drug Recognition System, it should occasionally be flushed with a 1 liter IV bag of distilled water mixed with 10 mL of white vinegar. Follow the procedure above for flushing the system using the vinegar solution, then repeat the procedure using plain distilled water. The system should be cleaned in this way about once every two months.

Anesthesia and Scavenging

The use of the HPS anesthesia features requires the addition of the HPS Anesthesia Delivery System. By adding this option to the HPS package, instructors can test a learner's critical thinking skills and skill acquisition in an area of medicine that has an inherent risk. The anesthesia system adds the ability for uptake and distribution of nitrous oxide and volatile anesthetics.

If you did not purchase the optional Anesthesia Delivery System and would like to add it to your HPS package, please contact your CAE Healthcare sales representative.

Introduction

The Human Patient Simulator's lungs consume oxygen, produce carbon dioxide and intake and eliminate real nitrous oxide, sevoflurane, isoflurane, enflurane and halothane in accordance with the principles of uptake and distribution. This capability is made possible by direct gas exchange within the lungs resulting in realistic inspired concentrations, exhaled concentrations and minimum alveolar concentrations (MAC) and appropriate wash-in and wash-out.

In order to control the direct exchange of anesthetic vapor in the HPS lungs, a supply of anesthetic is controlled just as analogous supplies of oxygen and carbon dioxide are controlled to create oxygen consumption and carbon dioxide production. As a result, computer-controlled concentrations of gas and vapor flow into the simulated patient's alveolar space, accomplishing appropriate consumption, production, wash-in and wash-out and alveolar and end-tidal concentrations.

The gas analyzer located in the HPS rack is an integral component controling the anesthetic vapor within the lungs. The available volatile agents recognized by the system are sevoflurane, isoflurane, enflurane and halothane.

IMPORTANT: Isoflurane is set as the default agent recognized by the gas analyzer. To assign a different volatile agent to the gas analyzer and ensure proper performance use the Rack Edit utility (RackEdit). Please see *Appendix F Using the RackEdit Utility* for more information.

The Anesthesia Delivery System

The Anesthesia Delivery System consists of a number of basic components located in the HPS Lab Rack. The system is housed beneath the anesthesia delivery system panel at the top of the rack. A syringe loaded into a syringe pump provides a reservoir for the supply of volatile anesthetic required by the system.

The syringe pump, which is controlled by a computer, dispenses small quantities of liquid anesthetic that is transported through a fine-gauge stainless steel needle to a vaporizer. The vaporizer is contained inside a large, cylindrical copper heat sink. Once the liquid anesthetic has reached the vaporizer, it evaporates and is transported to the simulated alveolar volume by the same gas flow that controls the concentrations of oxygen, nitrogen and carbon dioxide.

The components described in the preceding paragraphs are for using volatile anesthetic agents with the HPS system (e.g., isoflurane). Nitrous oxide is supplied to the HPS rack from an external source that is connected to the rack by a high-pressure (50 psi) hose. The flow of nitrous oxide into the HPS system is regulated by a mass flow controller (MFC) that is driven by the system's underlying pharmacological models. Once the nitrous oxide supply hose is connected to the back of the rack, there is no additional setup required.

NOTE: The optional HPS with Müse SCE Development software can be used on a computer other than the Instructor Workstation to create and run SCEs without being connected to the HPS simulator. When the same SCEs are run on SCE Development Software and on the Instructor Workstation, anesthetic gas concentrations displayed within Müse may vary slightly.

Hardware Setup Instructions

In most cases, the Anesthesia Delivery System is set up by a CAE Healthcare technician during your HPS installation. You may also follow the instructions below to set up the Anesthesia Delivery System yourself.

Step 1: Set Up External Components

a. Locate all of the following items (included with the Anesthesia Delivery System):

- 18-inch stainless steel needle with dual female luer fittings. (When shipped, this needle is normally taped to the copper vaporizer block, located on the inside of the HPS Lab Rack.)
- 30 mL glass syringe with male luer-lock fitting.
- Two-way stainless steel stopcock, with male luer and female luer-lock fittings

NOTE: If you are missing any of these items, contact CAE Healthcare for replacement.

b. Ensure the HPS Lab Rack is attached to the scavenging system of your anesthesia machine.

*Refer to **Scavenging** on page 220 for complete details.*

c. Ensure the 30 mL glass syringe is clean and empty.

d. Attach the two-way stainless steel stopcock and a suitable needle to draw up the liquid anesthetic. A 19-gauge, 4 cm spinal needle works well for this purpose.

NOTE: Do not use a needle with a plastic connector, as the anesthetic agents deteriorate the plastic.

e. Open the stopcock and, using the needle, draw up 6 mL of the liquid anesthetic agent.

f. Tighten the adjustment on the stopcock switch to prevent leakage.

g. Holding the syringe with the luer-lock fitting pointing upward, remove all air bubbles from the syringe and close the stopcock.

IMPORTANT: Leave the stopcock closed until the final step in these instructions.

h. Remove the needle and tap the stopcock on the inside edge of the anesthetic bottle to recover any excess drops of liquid anesthetic.

Step 2: Set Up the Anesthesia Delivery System in the HPS Lab Rack

a. Remove the front cover of the HPS Lab Rack by holding the hand grips on each side of the cover and pulling up and then out.

b. Locate the Anesthesia Delivery System on the top shelf of the rack. The Anesthesia Delivery System consists of a red syringe pump, a vaporizer and associated pneumatic tubing.

c. Find the 18-inch stainless steel needle and stopcock. The rack is shipped with the needle and stopcock attached to the metal bar in front of the Anesthesia Delivery System.

d. Detach the needle and stopcock from the metal bar and remove any packing materials.

e. Unlock the glass syringe from the red syringe pump housing by pulling and twisting the spring-loaded syringe holder.

f. Remove the syringe from the housing.

g. Remove any packaging materials from the syringe.

h. Screw the stopcock onto the syringe.

i. Ensure the stopcock lever is in the closed position.

j. Place the syringe in the syringe pump housing.

k. Adjust the plunger block on the pump so it is flush with the syringe plunger.

> **IMPORTANT:** Do not over-pressurize the syringe with the pump plunger block. This may cause anesthetic to be vaporized prematurely.

l. Lock down the syringe with the spring-loaded syringe holder.

m. Replace the front cover of the HPS Lab Rack.

NOTE: For subsequent use, the Anesthesia Delivery System can be accessed through the flip panel at the top of the HPS Lab Rack. However, when setting up the Anesthesia Delivery System for the first time, removing the front cover provides the easiest access to packaged components.

Step 3: Start Müse

a. Start the Müse software and perform the normal setup procedures.

> **IMPORTANT:** During lung calibration, ensure that the stainless steel stopcock on the glass syringe remains closed to prevent premature anesthetic vaporization.

b. Immediately prior to starting an SCE, carefully open the stainless steel stopcock on the syringe.

Operation

Once the Anesthesia Delivery System is configured, its operation is automatic and requires no user intervention. Dispense anesthesia to the HPS as you would to a normal patient.

Cleanup

Use the following cleanup steps after each simulation session in which the anesthetic vaporizer system is used.

1. Quit the Müse software. *For information on quitting Müse and shutting down the simulator, see **Breakdown** on page 247.*
2. Close the two-way stainless steel stopcock on the end of the glass syringe.
3. Disconnect the syringe/stopcock assembly from the 18-inch stainless steel needle.
4. Disconnect the stainless steel needle from the copper block vaporizer.
5. Return any unused liquid anesthetic to the original bottle for future use with the HPS.
6. Carefully flush with air, clean and dry the glass syringe, stopcock and stainless steel needle for future use with the HPS.
7. Using the quick connects, disconnect the inlet and outlet hoses of the copper block from the **MFC OUT** hoses.
8. Reconnect the two **MFC OUT** hoses to each other, removing the vaporizer from the configuration and returning the plumbing to its original configuration.

   IMPORTANT: Failure to return the plumbing to the original configuration may result in unrecognized system leaks.

Other Considerations

During setup, be careful not to get liquid anesthetic into the copper block vaporizer or the 18-inch stainless steel needle. This could lead to premature vaporization and unrealistic alveolar anesthetic vapor concentrations.

If, upon patient startup, abnormally high alveolar anesthetic concentrations are observed (e.g., greater than 1.0% displayed in the Alveolar Anesthetic Agents on the Patient Status Display), stop the simulation, shut down the software and turn the HPS Lab Rack off. Wait 10 seconds. Power the HPS Lab Rack on. Restart the Müse software as normal, opening the stainless steel stopcock after lung calibration and just prior to starting an SCE. If the problem persists, remove the glass syringe from the pump and disconnect it from the needle with the stopcock closed. Run Standard Man for a few minutes, until the alveolar gas concentrations of the volatile agent return to zero. These methods should resolve the problem.

6 mL of liquid anesthetic provides for about 30 minutes of wash-in at an inspired fraction of 1%, plus 30 minutes of wash-out at an inspired fraction of 0%.

CAE Healthcare recommends using Stan D. Ardman II for low-flow anesthesia simulation.

Scavenging

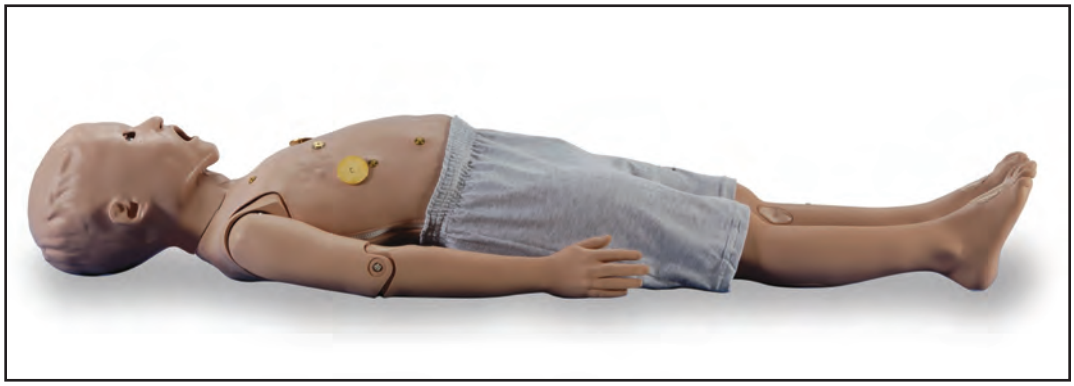
In order to accomplish the direct exchange of anesthetic vapors in the HPS lung, a sample of the alveolar gases is continually flowing from the HPS mannequin to the HPS Lab Rack. The gases are then exhausted from the HPS system and must be scavenged. An exhaust port is located on the rear panel of the HPS Lab Rack for this purpose. In order to scavenge HPS exhaust gases:

1. Locate the Scavenging fitting and tubing included with the HPS system.
2. Connect the fitting to the exhaust port on the rear panel of the HPS Lab Rack.
3. Connect the scavenging tubing to the scavenging equipment in your simulation center. Contact CAE Healthcare or the Biomedical Engineering Department at your institution for assistance locating the proper adapters to connect the supplied tubing to the particular scavenging equipment used in your facility.

IMPORTANT: Ensure that no more than 0.5 cm H_20 continued vacuum or pressure is applied to the HPS exhaust. Continued vacuum or pressure in excess of 0.5 cm H_20 can cause abnormal behavior and damage to the simulator.

PediaSIM HPS with Müse

The PediaSIM mannequin can interface with either of the HPS configurations (the HPS or the Health Science HPS) using a simple plug-and-play interface. To use the PediaSIM mannequin, simply set up the HPS simulator according to the instructions provided in the Setup section of this User Guide, substituting the PediaSIM mannequin for the HPS adult mannequin. The umbilicals that connect the PediaSIM mannequin to the HPS Lab Rack are identical to those on the HPS adult mannequin.



PediaSIM Mannequin

PediaSIM Patient Profiles

Müse comes with two preconfigured pediatric patients. Using one of these baseline patients as a starting point, you can create your own patients and scenarios to help isolate critical learning applications.

Andy Stevenson

Andy Stevenson is a healthy, six-year-old male child. He demonstrates a HR in the 100s, BP in the 100s/60s, RR in the low 20s and SpO_2 in the upper 90s on room air. The patient's cardiac rhythm is model driven normal sinus. Heart sounds are normal, breath sounds are clear in all lung fields and bowel sounds are normal in all four quadrants. The patient's weight is 20 kg.

Emily Liu

Emily Liu is a healthy, six-year-old female child. She demonstrates a HR in the 100s, BP in the 100s/60s, RR in the low 20s and SpO_2 in the upper 90s on room air. The patient's cardiac rhythm is model driven normal sinus. Heart sounds are normal, breath sounds are clear in all lung fields and bowel sounds are normal in all four quadrants. The patient's weight is 20 kg.

PediaSIM SCEs

There are two types of pre-installed SCEs for PediaSIM HPS with Müse: Base SCEs and Preconfigured SCEs.

Base SCEs are fundamental SCEs with no scenarios and no progression of events. Each base SCE is designed to provide facilitators with a baseline to run simulations "on the fly" or as a baseline from which to design their own SCEs.

Preconfigured SCEs are training tools with scenarios and multiple states. They are intended to be used for learner education and training.

PediaSIM Base SCEs

There are two base SCEs for PediaSIM HPS with Müse:

Healthy Female Child

Healthy Male Child

PediaSIM Preconfigured SCEs

Preconfigured SCEs are training tools with scenarios and multiple states. They are intended to be used for learner education and training.

There are four categories of PediaSIM HPS preconfigured SCEs: Allied Health, Anesthesia, Pediatric Advanced Life Support (PALS) and PALS Europe.

To access a preconfigured SCE from the SCE Library, choose **Learning Modules**, then click the name of the SCE category. The SCEs in the chosen category are displayed and available for selection.

The following preconfigured SCEs are included with PediaSIM HPS with Müse:

Allied Health

- Accidental Electrocution
- Accidental Overdose
- Closed Head Injury
- Diabetic Ketoacidosis with Hypoxemia
- Obstructed Airway
- Trauma with Pneumothorax

Anesthesia

- Cannot Intubate Cannot Ventilate
- Epidural High Spinal
- Foreigh Body Aspiration
- Hypertension and Tachycardia
- Spontaneous Tension Pneumothorax
- Upper Airway Obstruction

PALS

- Asthma Attack
- Asystole
- Bradycardia
- Ingestion
- Motor Vehicle Crash
- Pulseless Electrical Activity
- Septic Shock
- Shock
- Supraventricular and Ventricular Tachycardia
- Ventricular Fibrillation

PALS Europe

- Asthma Attack
- Asystole
- Bradycardia
- Ingestion
- Motor Vehicle Crash
- Pulseless Electrical Activity
- Septic Shock
- Shock
- Supraventricular and Ventricular Tachycardia
- Ventricular Fibrillation

Condition Guidelines for Programming PediaSIM HPS with Müse

This section is intended to help you select Müse conditions to achieve desired vital signs within each programmed state. All four conditions should be programmed into each state in the order presented below:

- Respiratory: Desaturation
- Cardiovascular: Blood Pressure
- Cardiovascular Heart Rate
- Respiratory: Respiratory Rate

The Müse software is physiologically driven. When using multiple conditions (e.g., Desaturation + Hypertension + Tachycardia + Tachypnea), physiological regulatory mechanisms such as the baroreceptor reflex and ventilatory control cause compensatory changes within parameters. To achieve the desired vital sign, select one condition level, above (greater) or below (less), to achieve the desired physiological effect.

NOTE: The following values are for the PediaSIM HPS simulator. For HPS values, please see *Appendix A - Condition Guidelines for Programming HPS with Müse*.

Respiratory: Desaturation

Desaturation	SpO_2 Value
Reset	98%
High 90s	96-97%
Mid 90s	94-95%
Low 90s	90-93%
High 80s	87-89%
Mid 80s	84-86%
Low 80s	80-83%
High 70s	77-79%
Mid 70s	74-76%
Low 70s	70-73%
Less than 70	<69%

Cardiovascular: Blood Pressure

Hypertension		Hypotension	
Reset	100s/60s	Reset	100s/60s
Increased	110s/70s	Decreased	90s/60s
Pre-Borderline	120s/70s	Pre-Borderline	80s/50s
Borderline	130s/80s	Borderline	70s/40s
Mild	140s/80s	Mild	60s/40s
Severe	150s/90s	Severe	50s/30s

Cardiovascular: Heart Rate

Tachycardia		Bradycardia	
Reset	100s	Reset	100s
Increased	110s	Decreased	90s
Elevated	120s	Pre-Borderline	80s
Pre-Borderline	130s	Borderline	70s
Borderline	140s	Moderate	60s
Intermediate	150s	Severe	50s
Mild	160s	Acute	40s
Severe	180s		
Profound	190s		
Acute	200s		

Respiratory: Respiratory Rate

Tachypnea		Bradypnea	
Reset	22	Reset	22
Increased	25	Decreased	20
Pre-Borderline	28	Pre-Borderline	18
Borderline	30	Borderline	16
Intermediate	33	Intermediate	14
Moderate	36	Mild	12
Severe	40	Moderate	10
		Severe	8
		Profound	6
		Extreme	4 - 5

Additional Conditions

The following pages provide programming guidelines for additional, specific PediaSIM HPS conditions.

When programming conditions, please allow the appropriate time for onset of vital signs. The onset time is noted in the Vital Signs section for each condition. Slight fluctuations in vital sign values may occur, and for some conditions (e.g., Acute Hypercapnia), drift of $PaCO_2$ values is likely.

Anxiety/Pain/Stress

The response to anxiety/pain/stress is driven by non-arterial baroreceptor influences that act on the medullary cardiovascular centers to raise the baroreceptor set-point. These disturbances cause sympathetic activity and arterial pressure to change in the same direction. The result is increased blood pressure and heart rate. Additionally, there is an increase in ventricular contractility secondary to an increase in venous return to the heart due to increased venous tone.[1]

Anxiety/Pain/Stress Parameter Adjustments

	Reset	Moderate	Severe	Extreme
Baroreceptor Maximum Pressure	102	110	120	133
Baroreceptor Minimum Pressure	62	70	80	93
Heart Rate Factor	1.00	1.25	1.32	1.50
Left Ventricle Contractility Factor	1.00	1.25	1.35	1.65
Systemic Vascular Resistance Factor	1.00	1.25	1.25	1.45
Venous Capacity Factor	1.00	0.95	0.95	0.95
Systemic Arteries Compliance Factor	1.00	0.75	0.60	0.50
Pulmonary Arteries Compliance Factor	1.00	0.75	0.60	0.50
O_2 Consumption	140	150	160	170
Respiratory Gain Factor	1.00	0.50	0.50	0.50
Respiratory Rate Factor	1.00	1.20	1.30	1.40

Anxiety/Pain/Stress Vital Signs

Approximate vital signs after two to three minutes in state

	Reset	Moderate	Severe	Extreme
Heart Rate (HR)	104	116	125	146
Blood Pressure (BP)	108/63	122/73	132/77	143/90
Mean Arterial Pressure (MAP)	82	95	104	117
Cardiac Output (CO)	3.4	3.5	3.7	3.7
Respiratory Rate (RR)	22	27	30	33
Oxygen Saturation (SpO_2)	98	98	98	98
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40	40	41	41

Acute Ventricular Failure

Left heart failure can cause right heart failure because of the increased afterload placed on the right ventricle. Clinical manifestations include shortness of breath, rales (crackles), jugular venous distention, pedal edema and third and fourth heart sounds.

Acute Ventricular Failure (Left and Right) Parameter Adjustments

	Reset	Mild	Moderate	Severe
Heart Rate Factor	1.00	1.05	1.10	1.15
Left Ventricle Contractility Factor	1.00	0.50	0.25	0.15
Right Ventricle Contractility Factor	1.00	0.50	0.25	0.15
Systemic Vascular Resistance Factor	1.00	1.20	1.30	1.50
Pulmonary Vasculature Resistance Factor	1.00	2.50	3.50	4.50
Systemic Arteries Compliance Factor	1.00	0.75	0.65	0.50
Pulmonary Arteries Compliance Factor	1.00	0.75	0.65	0.50
Shunt Fraction	0.02	0.15	0.20	0.25
Respiratory Rate Factor	1.00	1.00	1.10	1.20
Volume/Rate Control Factor	1.0	1.0	0.8	0.7
Breath Sounds	Normal	Normal	Normal	Crackles
Heart Sounds	Normal	Normal	S3 and S4	S3 and S4

Acute Ventricular Failure (Left and Right) Vital Signs

Approximate vital signs after three to five minutes in state

	Reset	Mild	Moderate	Severe
Heart Rate (HR)	104	100	115	126
Blood Pressure (BP)	108/63	100/60	93/57	87/54
Mean Arterial Pressure (MAP)	82	79	74	70
Pulmonary Artery Pressure (PAP)	23/8	29/11	26/12	23/13
Central Venous Pressure (CVP)	2	4	8	10
Pulmonary Capillary Wedge Pressure (PCWP)	6	6	7	9
Cardiac Output (CO)	3.4	2.7	2.3	1.9
Respiratory Rate (RR)	22	37	38	40
Oxygen Saturation (SpO_2)	98	95	92	86
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40	36	35	34

Acute Ventricular Failure (Left) Parameter Adjustments

	Reset	Mild	Moderate	Severe
Heart Rate Factor	1.00	1.05	1.10	1.15
Left Ventricle Contractility Factor	1.00	0.50	0.25	0.10
Systemic Vascular Resistance Factor	1.00	1.10	1.20	1.20
Systemic Arteries Compliance Factor	1.00	0.75	0.70	0.60
Pulmonary Arteries Compliance Factor	1.00	0.75	0.70	0.60
Shunt Fraction	0.02	0.15	0.27	0.30
Respiratory Rate Factor	1.00	1.00	1.10	1.20
Volume/Rate Control Factor	1.0	1.0	0.8	0.7
Breath Sounds	Normal	Normal	Normal	Crackles
Heart Sounds	Normal	Normal	S3	S3

Acute Ventricular Failure (Left) Vital Signs

Approximate vital signs after three to five minutes in state

	Reset	Mild	Moderate	Severe
Heart Rate (HR)	104	97	94	109
Blood Pressure (BP)	108/63	105/60	104/58	102/57
Mean Arterial Pressure (MAP)	82	82	81	77
Pulmonary Artery Pressure (PAP)	23/8	27/8	28/11	32/15
Central Venous Pressure (CVP)	2	2	2	2
Pulmonary Capillary Wedge Pressure (PCWP)	6	8	11	15
Cardiac Output (CO)	3.4	3.2	2.9	2.7
Respiratory Rate (RR)	22	37	38	40
Oxygen Saturation (SpO_2)	98	96	90	87
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40	36	37	36

Acute Ventricular Failure (Right) Parameter Adjustments

	Reset	Mild	Moderate	Severe
Heart Rate Factor	1.00	1.00	1.00	1.10
Right Ventricle Contractility Factor	1.00	0.50	0.20	0.10
Pulmonary Vasculature Resistance Factor	1.00	4.00	6.00	8.00
Systemic Arteries Compliance Factor	1.00	0.75	0.70	0.60
Pulmonary Arteries Compliance Factor	1.00	0.75	0.70	0.60
Shunt Fraction	0.02	0.15	0.22	0.30
Respiratory Rate Factor	1.00	1.00	1.05	1.10
Volume/Rate Control Factor	1.0	1.0	0.8	0.7
Heart Sounds	Normal	Normal	S4	S4

Acute Ventricular Failure (Right) Vital Signs

Approximate vital signs after three to five minutes in state

	Reset	Mild	Moderate	Severe
Heart Rate (HR)	104	103	110	124
Blood Pressure (BP)	108/63	104/57	93/53	85/52
Mean Arterial Pressure (MAP)	82	77	71	68
Pulmonary Artery Pressure (PAP)	23/8	27/10	25/11	16/10
Central Venous Pressure (CVP)	2	7	6	8
Pulmonary Capillary Wedge Pressure (PCWP)	6	6	4	3
Cardiac Output (CO)	3.4	3.0	2.5	2.3
Respiratory Rate (RR)	22	37	38	38
Oxygen Saturation (SpO_2)	98	96	91	86
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40	36	36	35

Idiopathic Hypotension

Idiopathic hypotension refers to low blood pressure in a healthy person (e.g., young and thin). Idiopathic hypotension is not a disease.

Idiopathic Hypotension Parameter Adjustments

	Reset	Mild	Moderate	Severe
Baroreceptor Maximum Pressure	102	90	85	75
Baroreceptor Minimum Pressure	62	55	45	35
Heart Rate Factor	1.00	1.03	1.10	1.15
Systemic Vascular Resistance Factor	1.00	0.75	0.70	0.65
Systemic Arteries Compliance Factor	1.00	1.00	1.30	1.30
Pulmonary Arteries Compliance Factor	1.00	1.00	1.20	1.15

Idiopathic Hypotension Vital Signs

Approximate vital signs after one to two minutes in state

	Reset	Mild	Moderate	Severe
Heart Rate (HR)	104	109	113	111
Blood Pressure (BP)	108/63	99/54	89/52	81/45
Mean Arterial Pressure (MAP)	82	72	66	58
Cardiac Output (CO)	3.4	3.5	3.4	3.2
Respiratory Rate (RR)	22	25	25	25
Oxygen Saturation (SpO_2)	98	98	98	98
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40	41	40	41

Acute Hypercapnia

The essential mechanism underlying all causes of hypercapnia is inadequate alveolar ventilation. Potential contributing factors include increased carbon dioxide production, decreased minute ventilation, increased airway resistance and inefficiency of alveolar gas exchange.[2] The most common causes are acute exacerbations of asthma and chronic obstructive pulmonary disease (COPD). This condition is programmed as an acute increase in total body carbon dioxide concentration, as might occur in trauma or after the removal of a tourniquet.

Acute Hypercapnia Parameter Adjustments

	Reset	Borderline	Mild	Moderate	Severe	Profound	Extreme
O2 Consumption	140	150	160	170	180	190	200
CO2 Production Factor	1.00	1.25	1.55	1.80	2.10	2.30	2.50
PaCO2 Set-point	40.0	44.0	48.0	51.0	55.0	59.0	63.0
Respiratory Gain Factor	1.00	0.10	0.10	0.10	0.10	0.10	0.10
Respiratory Rate Factor	1.00	1.10	1.25	1.45	1.65	1.85	2.05
Tidal Volume Factor	1.00	1.00	1.10	1.20	1.20	1.30	1.40

Acute Hypercapnia Vital Signs

Approximate vital signs after five to 10 minutes in state

	Reset	Borderline	Mild	Moderate	Severe	Profound	Extreme
Heart Rate (HR)	104	104	104	104	104	104	104
Blood Pressure (BP)	108/63	108/63	108/63	108/63	108/63	108/63	108/63
Mean Arterial Presssure (MAP)	82	82	82	82	82	82	82
Respiratory Rate (RR)	22	25	28	32	37	40	40
Oxygen Saturation (SpO_2)	98	97	97	97	97	96	95
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40	46	49	52	58	62	66

Chronic Obstructive Pulmonary Disease (COPD)/Emphysema

Obstructive lung disease describes obstruction to the flow of air through the airways and is characterized by decreased air flow rates during expiration. It is often accompanied by an elevated functional residual capacity resulting from trapped gas. COPD is the term applied to both emphysema and chronic bronchitis, diseases usually caused by chronic pulmonary irritation.[3]

COPD/Emphysema Parameter Adjustments

	Reset	Mild	Moderate	Severe	Very Severe
Baroreceptor Maximum Pressure	102	110	115	120	130
Baroreceptor Minimum Pressure	62	65	75	80	85
Heart Rate Factor	1.00	1.10	1.15	1.25	1.40
Right Ventricle Contractility Factor	1.00	1.20	1.30	1.40	1.50
Systemic Vascular Resistance Factor	1.00	1.00	1.15	1.30	1.40
Pulmonary Vasculature Resistance Factor	1.00	1.00	1.20	1.50	2.00
Systemic Arteries Compliance Factor	1.00	0.85	0.70	0.60	0.50
Pulmonary Arteries Compliance Factor	1.00	0.85	0.70	0.60	0.40
Shunt Fraction	0.02	0.12	0.20	0.30	0.38
Tidal Volume Factor	1.00	0.70	0.65	0.60	0.60
Volume/Rate Control Factor	1.0	0.7	0.7	0.7	0.7
I to E Ratio (1:X)	2.0	2.3	2.6	2.8	3.2
Lung Compliance Factor: Left	1.00	1.50	1.75	2.00	2.50
Lung Compliance Factor: Right	1.00	1.50	1.75	2.00	2.50
Functional Residual Capacity	700	750	800	850	900

COPD/Emphysema Vital Signs

Approximate vital signs after five to 10 minutes in state

	Reset	Mild	Moderate	Severe	Very Severe
Heart Rate (HR)	104	106	104	106	118
Blood Pressure (BP)	108/63	115/65	124/68	130/72	140/78
Mean Arterial Pressure (MAP)	82	87	94	102	109
Pulmonary Artery Pressure (PAP)	23/8	25/7	27/7	31/7	38/8
Pulmonary Capillary Wedge Pressure (PCWP)	6	6	6	6	5
Cardiac Output (CO)	3.4	3.5	3.5	3.4	3.5
Respiratory Rate (RR)	22	29	32	36	38
Tidal Volume (V_T)	190	170	180	185	195
Oxygen Saturation (SpO_2)	98	95	93	89	85
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40	43	42	42	42

Tension Pneumothorax

Pneumothorax is the result of accumulation of air or fluid in the pleural space. Tension pneumothorax occurs when the accumulated fluid creates a positive pressure in the pleural space, thereby exerting pressure on the great veins in the thorax and impairing venous return. The result is obstructive shock secondary to obstruction of the blood flow within the cardiovascular circuit. The results are hypotension, decreased cardiac output, increased arteriovenous oxygen difference and decreased myocardial oxygen consumption.[3]

Lung compliance and chest wall compliance decrease with increasing volume within the pleural space (intrapleural volume). In Müse, the **Chest Wall Capacity** parameter sets the total (combined) intrapleural and lung volumes at which the chest wall is considered distended. There should be a reduction in **Chest Wall Capacity** with a tension pneumothorax.

Tension Pneumothorax (Left) Parameter Adjustments

	Reset	Mild	Moderate	Severe	Extreme
Shunt Fraction	0.02	0.15	0.25	0.35	0.45
Intrapleural Volume (Right)	0	200	500	950	1200
Lung Compliance Factor (Left)	1.00	1.00	1.00	1.00	0.70
Lung Compliance Factor (Right)	1.00	0.75	0.50	0.25	0.15
Distended Chest Wall Compliance Factor	1.00	0.75	0.50	0.25	0.15
Chest Wall Capacity	2800	2800	2300	2100	2000

Tension Pneumothorax (Left) Vital Signs

Approximate vital signs after two to three minutes in state

	Reset	Mild	Moderate	Severe	Extreme
Heart Rate (HR)	104	97	92	94	114
Blood Pressure (BP)	108/63	103/62	101/60	96/60	80/57
Mean Arterial Pressure (MAP)	82	81	79	76	67
Pulmonary Arterial Pressure (PAP)	23/8	24/9	26/10	28/13	37/24
Central Venous Pressure (CVP)	2	3	7	12	24
Cardiac Output (CO)	3.4	3.2	3.1	2.7	1.6
Respiratory Rate (RR)	22	38	39	40	40
Oxygen Saturation (SpO_2)	98	96	92	83	65
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40	39	39	43	44

Tension Pneumothorax (Right) Parameter Adjustments

	Reset	Mild	Moderate	Severe	Extreme
Shunt Fraction	0.02	0.15	0.25	0.35	0.45
Intrapleural Volume (Right)	0	200	500	950	1200
Lung Compliance Factor (Left)	1.00	1.00	1.00	1.00	0.70
Lung Compliance Factor (Right)	1.00	0.75	0.50	0.25	0.15
Distended Chest Wall Compliance Factor	1.00	0.75	0.50	0.25	0.15
Chest Wall Capacity	2800	2800	2300	2100	2000

Tension Pneumothorax (Right) Vital Signs

Approximate vital signs after two to three minutes in state

	Reset	Mild	Moderate	Severe	Extreme
Heart Rate (HR)	104	97	92	94	114
Blood Pressure (BP)	108/63	103/62	101/60	96/60	80/57
Mean Arterial Pressure (MAP)	82	81	79	76	67
Pulmonary Arterial Pressure (PAP)	23/8	24/9	26/10	28/13	37/24
Central Venous Pressure (CVP)	2	3	7	12	24
Cardiac Output (CO)	3.4	3.2	3.1	2.7	1.6
Respiratory Rate (RR)	22	38	39	40	40
Oxygen Saturation (SpO_2)	98	96	92	83	65
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40	39	39	43	44

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1. Heller, L.J., & Morhman, D.E. (2006). *Cardiovascular physiology* (6th ed.). McGraw-Hill Medical Publishing Division.
2. Braunwald, E., Fauci, A., Hauser, S., Jameson, J., Kasper, D., & Longo, D. (Eds.) (2005). *Harrison's manual of medicine* (16th ed.). McGraw-Hill Medical Publishing Division
3. Andreoli, T.E., Carpenter, C.T., Griggs, R.C. & Loscalzo, J. (Eds.) (2004). *Cecil essentials of medicine* (6th ed.). Saunders.

HPS Care and Maintenance

Maintaining the HPS simulator requires careful treatment of the electronic and mechanical components. Each time the simulator is assembled or disassembled, make sure all components are properly handled and either removed from or placed into storage correctly.

HPS Warranty Programs

General Information

CAE Healthcare patient simulator products come with a one-year Manufacturer's Warranty (excluding batteries and consumables). All warranties begin at date of shipment or CAE Healthcare installation. You may upgrade your first year Warranty to an Enhanced Warranty and receive remedial and planned maintenance. To prevent equipment downtime and delays after your warranty expires, we encourage you to contract for extended maintenance services for all subsequent years.

Units Out of Agreement

For units no longer under warranty requiring repairs, the Time and Materials service plan will apply (see **Time and Materials** section).

To place an out-of-warranty unit under a warranty contract, CAE Healthcare reserves the right to have the patient simulator inspected by a CAE Healthcare-approved technician at the customer's expense. If necessary, the unit would have to be repaired at the customer's expense prior to issuance of a warranty contract.

The repairs required, as the result of the examination, will be quoted on a time and material basis.

How to Contact Customer Service

CAE Healthcare Customer Service Headquarters - United States and Latin America
Monday - Friday from 7:00 a.m. to 6:00 p.m. ET
Toll Free +1 (866) 462-7920
24-hour Hotline +1 (941) 342-5605
Fax +1 (941) 342-5600
Email Address: customerservice@caehealthcare.com
Web URL: www.caehealthcare.com

CAE Healthcare Customer Service - Canada
Monday - Friday from 8:00 a.m. to 5:00 p.m. ET
Toll Free +1 (877) 223-6273
Email Address: can.service@caehealthcare.com

CAE Healthcare Customer Service - Europe, Middle East and Africa (EMEA)
Monday - Friday from 8:00 a.m. to 5:00 p.m. CET
Phone +49 (0) 6131 4950354
Fax +49 (0) 6131 4950351
Email Address: international.service@caehealthcare.com

CAE Healthcare Customer Service - UK and Ireland
Monday - Friday from 9:00 a.m. to 5:00 p.m. GMT
Phone +44 (0)800-917-1851
Email Address: uk.service@caehealthcare.com

Principal hours of operation exclude holiday and non-business days.

Contract Period

Warranty contracts are not ordinarily offered for periods of less than one year. However, multiple-year warranty contracts may be arranged for up to an additional three years. Discounts are available for purchase of multiple year contracts.

Limitations of Agreement

Your exclusive remedy for any defective patient simulator is limited to the repair or replacement of the defective patient simulator.

CAE Healthcare may elect which remedy or combination of remedies to provide at its sole discretion. CAE Healthcare shall have a reasonable time after determining that a defective material exists to repair or replace defective material. CAE Healthcare ‘s replacement material will be manufactured from new and/or serviceable parts. CAE Healthcare's agreement applies to repaired or replaced materials for the balance of the applicable period of the original warranty or ninety days from the date of shipment of a repaired or replaced material, whichever is longer. CAE Healthcare warrants its LABOR for 30 days or the balance at the applicable period of the original warranty, whichever is greater.

CAE Healthcare shall not be liable under this warranty for incidental or consequential damages, or in the event of any unauthorized repairs or modifications have been made or attempted, or when the product, or any part thereof, has been damaged by accident, misuse or abuse. This warranty does not cover normal wear and tear, staining, discoloration or other cosmetic irregularities that do not impede or degrade product performance. Any damage or malfunction as a result of the installation of software or hardware, not authorized by CAE Healthcare, will be repaired under the Time and Materials service plan (see **Time and Materials** section).

CAE Healthcare's warranty does not cover products that have been received improperly packaged, altered or physically damaged. Products will be inspected upon receipt.

Some states in the USA do not allow the exclusion or limitations of incidental or consequential damages, so the limitations above may not apply to you. This warranty gives you specific legal rights and you may also have other rights, which vary from state to state.

Return Materials Authorization (RMA)

No product may be returned directly to CAE Healthcare without first contacting CAE Healthcare for an RMA number. If it is determined that the product may be defective, you will be given an RMA number and instructions for product return. An unauthorized return, e.g., one for which an RMA number has not been issued, will be returned at your expense. Authorized shipments are to be shipped prepaid to the address on the RMA. Your original box and packaging materials should be kept for storing or shipping your product. To request an RMA, please contact Customer Service.

System Software Upgrade Support

Customers with current warranty contracts are entitled to receive upgrades to applications software previously purchased. Installation of the system software is the user's responsibility.

The System Software Upgrades Support includes software upgrades for base software and purchased optional software modules.

This does not apply for major upgrades or technological enhancements.

Pricing Structure

Time and Materials

For those systems not under agreement, service will be provided as required on a Time and Material basis:

Description	In-House	On-Site
Technical Support	As quoted at time of repair	CAE Healthcare's prevailing labor rate with a minimum of four hours labor
Material	As quoted at time of repair	As quoted at time of repair
Travel	N/A	Priced at CAE Healthcare's fully burdened cost plus fee

Principal period of on-site support (customer's local time) is:

- Monday through Friday, 8:00 AM to 5:00 PM (customer's time zone)
- Holiday and non-business days excluded
- Support outside the principle period is billed at the premium rate (hourly rate x 1.5)

A minimum of 48 hours notice is required for scheduling an on-site support call. Urgent on-site support with less that 48 hours notice will be charged at the premium hourly rate.

On-site time is described as the time period commencing from arrival at customer site through departure from customer site.

Breakdown

After each use, the HPS simulator should be properly disassembled and stored in a secure place. To ensure that the HPS remains in good working condition, follow the prescribed breakdown procedures below. These procedures are estimated to take less than 30 minutes.

	Breakdown Steps
1	Clean the Simulator and the Fluid System
2	Shut Down the Software
3	Power Off the HPS Lab Rack
4	Power Off the Clinical Monitor
5	Turn Off All Gases

Step 1: Clean the Simulator and the Fluid System

*For detailed instructions on cleaning, refer to **Maintenance Advice** on page 249.*

Step 2: Shut Down the Software

To shut down the Müse software on the Instructor Workstation:

a. In the Müse software, click the **Disconnect** icon on the Run screen.

b. Stop any running SCEs. The Stop Simulation dialog box appears.

c. Click the **Stop Simulation** button. The simulation stops and the Home page is shown.

d. Click the Account Name in the lower, right-hand corner of the screen. The Logout dialog box appears.

e. Click **Logout** to exit the software.

To shut down the TouchPro software (optional):

a. Click the **Settings** button in the bottom, right-hand corner of the TouchPro screen.

b. From the Settings menu, click **Shutdown**. A warning box appears asking if you want to exit.

c. Click **Shutdown**.

If using a Wireless Remote Control, quit Müse using the same steps described above for the Instructor Workstation.

Step 3: Power Off the HPS Lab Rack

a. Turn off the main power switch near the bottom of the back panel of the HPS Lab Rack.

Step 4: Power Off the Clinical Monitor

a. Turn off the clinical monitor (if used).

Step 5: Turn Off All Gases

a. Turn off all gases used with the simulator.

Maintenance Advice

Simple care and maintenance helps to ensure the HPS simulator stays in good working condition. Many problems are caused by inadequate or improper maintenance. Perform a thorough check of the various components each time the simulator is used.

The Mannequin

Avoid the use of writing instruments and sharp objects near the mannequin to prevent unattractive markings on or tears in the skin. Ink cannot be removed from the mannequin's skin.

A mild detergent and warm water remove most marks and stains. Gently rub the soiled area with a soft cloth. Do NOT use ABRASIVE soaps or pads.

A citrus-based cleaner or a product such as Goof Off® may be used to remove stains that cannot be removed with mild detergent and water. Follow the manufacturer's practices and warnings when using these types of cleaners. Do NOT use ABRASIVE cleaners or pads.

Prior to using moulage of any kind in your session, CAE Healthcare suggests the application of a very light coating of petroleum jelly, followed by a light dusting of baby powder to the mannequin's skin. This application makes cleaning the skin easier.

After using moulage, use alcohol and gauze or a gentle cleaning solvent (as mentioned above) followed by soap and a damp cloth to clean the mannequin.

After using any of the trauma, genitourinary or IV features of the HPS, carefully flush the mannequin with distilled water. Depending on the features you are using, this process may require more than one complete flush. Failure to flush the systems may cause problems for the system during attempts at future use.

NOTE: For complete flushing instructions, please refer to the **Using the HPS** section of this User Guide.

Always store the mannequin horizontally. Never place anything on top of the mannequin during storage.

Care of Electronic Equipment

Do NOT use any of the computer components associated with this system for any other use.

Do NOT connect the computer components to any network of any kind.

Install any CAE Healthcare software updates as soon as they become available.

Checking the Airway

The HPS is equipped with an anatomically accurate airway that supports the practice of difficult airway management techniques. In the process of performing these techniques improperly or aggressively, the upper airway can be damaged. While such damage may be readily apparent during mechanical ventilation (manifested as a "leak in the breathing circuit"), it may not be obvious during spontaneous or bag and mask ventilation.

Occasional visual inspection of the airway is recommended. Using the light of a laryngoscope blade or a flashlight, visually examine both the upper and lower airway. While tears in the upper airway resulting from intubation may be obvious, needle holes in the lower bronchus resulting from techniques such as transtracheal jet ventilation may require close inspection to be detected.

*If damage to the airway is found, refer to **Repairing Cuts and Abrasions to the Mannequin** on page 257 or consult CAE Healthcare Customer Service.*

Removing the Chest Skin

From time to time, certain maintenance steps require the removal of the chest skin. Ensure this is done with care.

To remove the chest skin:

1. Disconnect any ECG monitoring leads and unscrew the defibrillation and/or pacing disks from the mannequin chest plate.
2. Unzip the chest skin.
3. Remove the abdominal cavity.
4. Disconnect the speaker connections and ECG leads from the mannequin's upper right quadrant.
5. Gently pull both sides of the skin toward the mannequin's head.
6. Slowly lift the chest skin from the chest plate.

IMPORTANT: Be careful to avoid snagging the ECG lead wires on the chest plate.

Replacing the Chest Skin

To replace the chest skin:

1. Re-connect the speaker connections and ECG leads at the mannequin's upper right quadrant.
2. Replace the abdominal cavity.
3. Replace the chest skin on the chest plate, aligning it with the chest tube attachment.
4. Zip the chest skin.

Replacing the Chest Tube Foam Inserts

The chest tube foam inserts can be replaced as needed. To replace the chest tube foam inserts:

1. Make sure the chest tube feature has been drained. *For information on draining the chest tube, see* ***Draining the Chest Tube*** *on page 253.*
2. Pull back the chest skin, exposing the foam inserts on each side of the mannequin's upper chest.
3. Remove the foam insert you want to replace.
4. Retrieve a new foam insert from the Replacement Kit and place a drop of super glue on each of the four sides that will touch the sides of the reservoir in the mannequin's chest.
5. Place the new foam insert in the reservoir.

Maintaining Trauma Features

Follow the steps below to clean and flush the trauma features after each use:

Draining the Chest Tube

The following instructions provide details on how to drain the chest tube feature and how to replace the chest tube foam inserts.

The chest tube feature must be drained prior to storing after use. This reduces the buildup of sediment that may clog the tubing inside the mannequin.

To drain the chest tube:

1. Ensure the Müse software is running and a patient is connected to the simulator.
2. Disconnect the IV bag from the **TRAUMA IN** hose at the back of the rack.
3. In Müse, from the Respiratory view, click **Chest Tube** and select **Prime**.
4. Place the chest tube priming tube inside a bucket to collect the fluid that drains from the unit.
5. Use a syringe to push air into the line.
6. The fluid should drain into the collection bucket.
7. Continue to push air through the line until there is nothing but air coming out of the chest tube.
8. In Müse, from the Respiratory view, click **Chest Tube** and select **Disable**.

IMPORTANT: The system must be cleaned in the prescribed way to prevent damage the flowmeter.

Draining the Pericardiocentesis Feature

To drain and flush the pericardiocentesis trauma feature:

1. Ensure the Müse software is running and a patient is connected to the simulator.
2. Disconnect the IV bag from the **TRAUMA IN** hose at the back of the rack.
3. In Müse, from the Respiratory view, click **Chest Tube** and select **Prime**.
4. Place the chest tube priming tube inside a bucket to collect the fluid that drains from the unit.
5. Use a syringe to push air into the line.
6. The fluid should drain into the collection bucket.
7. Continue to push air through the line until there is nothing but air coming out of the chest tube.
8. In Müse, from the Respiratory view, click **Chest Tube** and select **Disable**.
9. Unzip and pull back the chest skin, exposing the pericardiocentesis mechanism. *For information on removing the chest skin, see **Removing the Chest Skin** on page 251.*
10. Remove the red tape from the pericardiocentesis mechanism, exposing the pericardiocentesis orifice.
11. In Müse, from the Cardiovascular view, click **Pericardiocentesis Enable** and select **Prime**.
12. Insert a needle with a 30 mL syringe into the pericardiocentesis reservoir and slowly draw up all the fluid in the reservoir until nothing but air flows into the syringe.
13. In Müse, from the Cardiovascular view, click **Pericardiocentesis Enable** and select **Disable**.

Replacing the Needle Decompression Tape

The red tape that covers the needle decompression cones inside the mannequin torso should be replaced after each procedure.

1. Unzip the chest skin to access the left and right needle decompression cones.
2. Carefully peel back the red tape on each cone used during the session and replace it with a new piece of tape from the spool included in the mannequin Replacement Kit.
3. Once the tape is replaced, carefully replace the mannequin chest skin, making sure not to disconnect any of the electrical wiring attached to the internal area of the skin covering.

Maintaining the IV System

After using the IV System in a simulator exercise, it must be flushed and purged. Complete the following steps to ensure proper performance of the system during subsequent simulator exercises:

1. Ensure the HPS Lab Rack is powered on.
2. Flush the system with one liter of distilled water.
   a. Ensure the IV reservoir bag in the rear of the HPS rack has enough room to hold one additional liter of fluid.
   b. Replace the IV supply with a 1 liter IV bag of distilled water. Prime the bulb of the IV stake and ensure flow has started. Allow the water to flow until the bag is empty.
3. Close the clamps on both the IV supply and the reservoir.
4. Remove the IV bags from the stake sets and drain them appropriately.
5. With a large syringe, flush the IV port with air (as though dispensing a bolus of air) until all water is dissipated.

IMPORTANT: The system must be cleaned after each use to prevent damage.

IMPORTANT: The system must be cleaned in the prescribed way to prevent damage to the flowmeter.

IMPORTANT: To prevent mold, mildew and fungus from growing in the Drug Recognition System, it should occasionally be flushed with a 1 liter IV bag of distilled water mixed with 10 mL of white vinegar. Follow the procedure above for flushing the system using the vinegar solution, then repeat the procedure using plain distilled water. The system should be cleaned in this way about once every two months.

Maintaining the GU System

After using the Genitourinary (GU) System in a simulator exercise, it must be flushed and purged. Complete the following steps to ensure proper performance during subsequent simulator exercises:

1. Ensure the HPS Lab Rack is powered on.
2. Ensure the Müse software is running and a patient is connected to the simulator.
3. Ensure a urinary catheter is inserted in the mannequin's genitalia and a urine collection bag with ample room for fluid is attached to the catheter.
4. If any fluid other than distilled water was inadvertently used during the simulation exercise, or if food coloring was added to the GU fluid supply, flush the system with at least 1 liter of distilled water.
    a. Replace the GU supply IV bag with a 1-liter IV bag of distilled water. Prime the bulb of the IV stake and ensure that flow has started.
    b. In Müse, from the **Fluids** view, choose **Urine Output**.
    c. Move the slider to 500 or type *500* in the **ml/hr** field and click **Accept**.
    d. Fluid begins to flow through the simulator's GU system and into the urine collection bag.
    e. When the fluid flowing into the urine collection bag is clear, move the **Urine Output** slider to 0 or type *0* in the **ml/hr** field.
    f. Click **Accept**.
    g. Close the clamp on the GU supply IV bag.
    h. Remove the IV bag from the stake set and disconnect the stake set from the GU fitting on the mannequin umbilical.
5. Remove the GU tubing from the GU pump so air and fluid can flow freely through it.
6. With a large syringe connected to the GU fitting of the mannequin umbilical, flush the system with air (as though dispensing a bolus of air) until no water remains in the system.
7. Disconnect and drain the urine collection bag.
8. Replace the empty IV bag in the system or store it appropriately.
9. The urinary catheter and urine collection bag can be left in place or removed as desired.

To prevent mold, mildew and fungus from growing in the GU system, occasionally flush the system with a 1-liter IV bag of distilled water mixed with 10 mL of white vinegar. Follow the procedure above for flushing the system using the vinegar solution, then repeat the procedure using plain distilled water. The system should be cleaned in this way about once every two months.

Repairing Cuts and Abrasions to the Mannequin

Cuts and abrasions to the HPS mannequin can be repaired easily using readily available materials. Perform the following steps if a cut is found:

1. Clean the area around the cut thoroughly using alcohol swabs or liquid alcohol and cotton balls.
2. Allow the area to dry completely.
3. Apply a small bead of cyanoacrylate adhesive (e.g., Super Glue®) to the surfaces to be repaired.
4. Wipe away excess glue with a cotton swab.
5. Firmly press the surfaces together, taking care not to touch the wetted areas.

The following tips may be useful in the procedure above:

The repaired area may be gently "sanded" using a fine grit paper.

A patch may be formed from the skin used to cover the crichothyroid cartilage to cover large cuts.

Disposable examination gloves are recommended to prevent inadvertent adhesion of skin to the mannequin.

Contact CAE Healthcare Customer Service to effect permanent repair of damaged mannequins.

Using the IV Arm Kit

Over time, the IV arm becomes worn and the skin or veins may need to be replaced using the contents of the IV Arm Kit included in the mannequin Replacement Kit.

Replacing the IV Arm Skin

To replace the skin:

1. Remove the used skin.
2. Sprinkle talcum powder from the packet enclosed with the IV Arm Kit into the interior of the new skin.
3. Shake out the excess powder and slide the new skin over the hand. Pull it into place over the arm.
4. Palpate the veins to make sure they are positioned in the channel on the arm and hand.

Replacing the IV Arm Veins

To replace the veins:

1. Pull down the skin of the arm.
2. Remove the section of tubing that needs to be replaced by cutting the tubing on each side of the affected area. Leave at least 1" (2.5 cm) of the vein extending from the molded arm to ensure enough material in which to install butt connectors.
3. Insert one of the supplied butt connectors into each of the ends of tubing.
4. Retrieve a new piece of tubing from the Replacement Kit, cutting it to the same length as the piece you are replacing.
5. Install the new section by lubricating the butt connectors and sliding the new vein all the way over the connectors. Be sure the tubing is applied all the way onto the connectors on both ends of the replacement section of tubing.
6. Replace the skin over the mannequin's arm.

Drug Recognition Barcode Labels

Eventually, barcode labels become worn. Their life is extended if they are kept as dry as possible. Contact CAE Healthcare Customer Service for replacements.

Recommended Clinical Supply Sizes

The following clinical supply sizes are recommended for use with the simulator. Other sizes may cause damage and should not be used.

Clinical Supply	Recommended Size - Adult	Recommended Size - PediaSIM
Urinary Catheter	14 to 16 Fr	10 Fr
Nasogastric Tube	14 Fr**	10 Fr**
ETT	7.0 to 8.0 mm	5 mm
LMA Unique	#3	#2
Combitube	37 Fr	Not Supported
Oropharyngeal Airway	90 mm	60 mm
Nasal-Pharyngeal Airway	30 Fr 7.5 mm	24 Fr 6 mm
Tracheostomy Tube	6 mm	3.5 mm
IV Cannula	18 to 22 gauge	20 to 22 gauge
Chest Tube	24 to 28 Fr	20 Fr
Needle Decompression	14 gauge 6 cm	14 gauge 6 cm
Pericardiocentesis	16 to 18 gauge 10 to 15 cm	Not supported

**Insertion only

Appendix A - Condition Guidelines for Programming HPS with Müse

This section is intended to help you select Müse conditions to achieve desired vital signs within each programmed state. All four conditions should be programmed into each state in the order presented below:

- Respiratory: Desaturation
- Cardiovascular: Blood Pressure
- Cardiovascular Heart Rate
- Respiratory: Respiratory Rate

The Müse software is physiologically driven. When using multiple conditions (e.g., Desaturation + Hypertension + Tachycardia + Tachypnea), physiological regulatory mechanisms such as the baroreceptor reflex and ventilatory control cause compensatory changes within parameters. To achieve the desired vital sign, select one condition level, above (greater) or below (less), to achieve the desired physiological effect.

NOTE: The following values are for the HPS simulator. *For PediaSIM HPS values, please see* ***Condition Guidelines for Programming PediaSIM HPS with Müse*** *on page 225 of this User Guide.*

Respiratory: Desaturation

Desaturation	SpO_2 Value
Reset	98%
High 90s	96-97%
Mid 90s	94-96%
Low 90s	91-93%
High 80s	87-90%
Mid 80s	84-86%
Low 80s	80-83%
High 70s	77-80%
Mid 70s	74-77%
Low 70s	69-71%
Less than 70	<69%

Cardiovascular: Blood Pressure

Hypertension		Hypotension	
Reset	110s/70s	Reset	110s/70s
Increased	120s/80s	Decreased	100s/70s
Pre-Borderline	130s/80s	Pre-Borderline	100s/60s
Borderline	140s/90s	Borderline	90s/50s
Mild	150s/90s	Mild	80s/40s
Moderate	160s/100s	Moderate	70s/40s
Severe	170s/100s	Severe	60s/30s
Profound	190s/110s	Profound	50s/30s
Extreme	220s/120s	Extreme	40s/30s

Cardiovascular: Heart Rate

Tachycardia		Bradycardia	
Reset	70s	Reset	70s
Increased	High 70s	Decreased	Mid 60s
Elevated	80s	Pre-Borderline	Low 60s
Pre-Borderline	90s	Borderline	Mid 50s
Borderline	100s	Intermediate	Low 50s
Intermediate	110s	Mild	High 40s
Mild	120s	Moderate	Mid 40s
Moderate	130s	Severe	Low 40s
Severe	140s	Extreme	Mid 30s
Supra	150s	Acute	Low 30s
Profound	160s		
Extreme	170s		
Acute	High 170s		

Respiratory: Respiratory Rate

Tachypnea		Bradypnea	
Reset	11	Reset	11
Increased	15	Increased	10
Elevated	18	Intermediate	9
Borderline	20	Mild	7
Intermediate	22	Moderate	6
Mild	25	Severe	5
Moderate	28	Profound	3
Severe	31	Extreme	2
Profound	33		
Extreme	36		

Additional Conditions

The following pages provide programming guidelines for additional, specific patient conditions.

When programming conditions, please allow the appropriate time for onset of vital signs. The onset time is noted in the Vital Signs section for each condition. Slight fluctuations in vital sign values may occur, and for some conditions (e.g., Acute Hypercapnia), drift of $PaCO_2$ values is likely.

Anxiety/Pain/Stress

The response to anxiety/pain/stress is driven by non-arterial baroreceptor influences that act on the medullary cardiovascular centers to raise the baroreceptor set-point. These disturbances cause sympathetic activity and arterial pressure to change in the same direction. The result is increased blood pressure and heart rate. Additionally, there is an increase in ventricular contractility secondary to an increase in venous return to the heart due to increased venous tone.[1]

Anxiety/Pain Stress Parameter Adjustments

	Reset	Moderate	Severe	Extreme
Baroreceptor Maximum Pressure	112	120	130	134
Baroreceptor Minimum Pressure	72	80	85	88
Heart Rate Factor	1.00	1.35	1.55	1.67
Left Ventricle Contractility Factor	1.00	1.20	1.30	1.30
Systemic Vascular Resistance Factor	1.00	1.20	1.30	1.35
Venous Capacity Factor	1.00	1.00	0.95	0.95
Systemic Arteries Compliance Factor	1.00	0.50	0.50	0.50
Pulmonary Arteries Compliance Factor	1.00	0.50	0.50	0.50
O_2 Consumption	250	270	285	300
Respiratory Gain Factor	1.00	1.00	0.50	0.50
Respiratory Rate Factor	1.00	1.25	2.00	3.00

Anxiety/Pain Stress Vital Signs

Approximate vital signs after three minutes in state

	Reset	Moderate	Severe	Extreme
Heart Rate (HR)	71	85	94	102
Blood Pressure (BP)	118/77	133/82	142/93	151/98
Mean Arterial Pressure (MAP)	93	106	116	120
Cardiac Output (CO)	5.2	5.4	5.7	5.8
Respiratory Rate (RR)	13	15	20	28
Oxygen Saturation (SpO_2)	98	98	98	98
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40 to 41	40 to 41	39 to 40	38 to 39

Chronic Hypertension

In chronic hypertension, the blood-pressure-regulating reflexes become adapted or "reset" to regulate blood pressure at a higher than normal level. Additionally, there is an increased total peripheral (systemic) vascular resistance.

The programming of this condition is based on the following blood pressure categories, defined by the American Heart Association[2]:

Category	Systolic (mm Hg)		Diastolic (mm Hg)
Normal	lower than 120	and	lower than 80
Pre-Hypertension	120 to 139	or	80 to 89
Stage One	140 to 159	or	90 to 99
Stage Two	160 or higher	or	100 or higher
Stage Three	higher than 180	or	higher than 110

Chronic Hypertension Parameter Adjustments

	Reset	Pre-Hypertension	Stage One	Stage Two	Stage Three	Isolated Hypertension
Baroreceptor Maximum Pressure	112	125	145	150	175	126
Baroreceptor Minimum Pressure	72	85	100	110	130	86
Systemic Vascular Resistance Factor	1.00	1.10	1.38	1.55	1.95	1.03
Venous Capacity Factor	1.00	1.00	1.00	1.00	1.00	0.94
Systemic Arteries Compliance Factor	1.00	0.60	0.50	0.50	0.50	0.50
Pulmonary Arteries Compliance Factor	1.00	0.60	0.50	0.35	0.35	0.50

Chronic Hypertension Vital Signs

Approximate vital signs after one to two minutes in state

	Reset	Pre-Hypertension	Stage One	Stage Two	Stage Three	Isolated Hypertension
Heart Rate (HR)	71	71	71	71	71	71
Blood Pressure (BP)	118/77	135/81	153/94	160/102	182/126	142/77
Mean Arterial Pressure (MAP)	93	106	122	130	152	107
Cardiac Output (CO)	5.2	5.4	5.4	5.2	5.2	5.8
Respiratory Rate (RR)	13	13	13	13	13	13
Oxygen Saturation (SpO_2)	98	98	98	98	98	98
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40 to 41	41 to 42	41 to 42	41 to 42	41 to 42	41 to 42

NOTE: Isolated hypertension is a chronic condition affecting elderly patients. With isolated hypertension, systolic blood pressure increases more than diastolic blood pressure.

Acute Ventricular Failure

Left heart failure can cause right heart failure because of the increased afterload placed on the right ventricle. Clinical manifestations include shortness of breath, rales (crackles), jugular venous distention, pedal edema and third and fourth heart sounds.

Acute Ventricular Failure (Both) Parameter Adjustments

	Reset	Mild	Moderate	Severe
Left Ventricle Contractility Factor	1.00	0.70	0.25	0.18
Right Ventricle Contractility Factor	1.00	0.70	0.25	0.18
Systemic Vascular Resistance Factor	1.00	1.40	1.55	1.60
Pulmonary Vasculature Resistance Factor	1.00	2.50	3.50	4.50
Systemic Arteries Compliance Factor	1.00	0.75	0.65	0.50
Pulmonary Arteries Compliance Factor	1.00	0.75	0.65	0.50
Shunt Fraction	0.02	0.16	0.22	0.25
Respiratory Rate Factor	1.00	1.20	1.55	2.20
Volume/Rate Control Factor	1.0	0.7	0.5	0.5
Breath Sounds	Normal	Normal	Normal	Crackles
Heart Sounds	Normal	Normal	S3 and S4	S3 and S4

Acute Ventricular Failure (Both) Vital Signs

Approximate vital signs after three to five minutes in state

	Reset	Mild	Moderate	Severe
Heart Rate (HR)	71	81	122	139
Blood Pressure (BP)	118/77	115/81	91/71	74/57
Mean Arterial Pressure (MAP)	93	96	78	64
Pulmonary Artery Pressure (PAP)	20/8	27/14	24/18	21/17
Central Venous Pressure (CVP)	1	1	6	10
Pulmonary Capillary Wedge Pressure (PCWP)	2 to 4	4 to 5	6 to 7	8 to 10
Cardiac Output (CO)	5.2	4.3	2.7	2.0
Respiratory Rate (RR)	13	18	21	30
Oxygen Saturation (SpO_2)	98	95	89	83
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40 to 41	34 to 35	32 to 33	29 to 30

Acute Ventricular Failure (Left) Parameter Adjustments

	Reset	Mild	Moderate	Severe
Left Ventricle Contractility Factor	1.00	0.50	0.20	0.10
Systemic Vascular Resistance Factor	1.00	1.40	1.40	1.40
Systemic Arteries Compliance Factor	1.00	0.75	0.75	0.85
Pulmonary Arteries Compliance Factor	1.00	0.75	0.70	0.65
Shunt Fraction	0.02	0.17	0.27	0.30
Respiratory Rate Factor	1.00	1.20	1.40	2.00
Volume/Rate Control Factor	1.0	0.7	0.6	0.5
Breath Sounds	Normal	Normal	Normal	Crackles
Heart Sounds	Normal	Normal	S3	S3

Acute Ventricular Failure (Left) Vital Signs

Approximate vital signs after four to five minutes in state

	Reset	Mild	Moderate	Severe
Heart Rate (HR)	71	76	90	115
Blood Pressure (BP)	118/77	122/84	111/81	98/74
Mean Arterial Pressure (MAP)	93	98	95	83
Pulmonary Artery Pressure (PAP)	20/8	22/8	21/10	24/15
Central Venous Pressure (CVP)	1	1	1	3
Pulmonary Capillary Wedge Pressure (PCWP)	2 to 4	5 to 6	9 to 10	14 to 16
Cardiac Output (CO)	5.2	4.6	4.2	3.4
Respiratory Rate (RR)	13	19	22	28
Oxygen Saturation (SpO_2)	98	95	90	86
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40 to 41	33 to 34	32 to 33	31 to 32

Acute Ventricular Failure (Right) Parameter Adjustments

	Reset	Mild	Moderate	Severe
Right Ventricle Contractility Factor	1.00	0.50	0.25	0.12
Pulmonary Vasculature Resistance Factor	1.00	6.00	7.50	9.00
Systemic Arteries Compliance Factor	1.00	0.75	0.65	0.50
Pulmonary Arteries Compliance Factor	1.00	0.75	0.75	0.75
Shunt Fraction	0.02	0.18	0.24	0.28
Respiratory Rate Factor	1.00	1.30	1.50	2.00
Volume/Rate Control Factor	1.00	0.7	0.6	0.5
Heart Sounds	Normal	Normal	S4	S4

Acute Ventricular Failure (Right) Vital Signs

Approximate vital signs after four to five minutes in state

	Reset	Mild	Moderate	Severe
Heart Rate (HR)	71	96	119	135
Blood Pressure (BP)	118/77	106/74	96/70	73/53
Mean Arterial Pressure (MAP)	93	88	80	62
Pulmonary Artery Pressure (PAP)	20/8	34/22	27/19	25/18
Central Venous Pressure (CVP)	1	3	5	10
Pulmonary Capillary Wedge Pressure (PCWP)	2 to 4	3 to 4	3 to 4	7 to 8
Cardiac Output (CO)	5.2	4.6	3.9	2.6
Respiratory Rate (RR)	13	20	24	29
Oxygen Saturation (SpO_2)	98	95	91	84
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40 to 41	33 to 34	30 to 31	30 to 31

Idiopathic Hypotension

Idiopathic hypotension refers to low blood pressure in a healthy person (e.g., young and of healthy weight). Idiopathic hypotension is not a disease.

Idiopathic Hypotension Parameter Adjustments

	Reset	Mild	Moderate	Severe
Baroreceptor Maximum Pressure	112	100	95	80
Baroreceptor Minimum Pressure	72	60	55	40
Heart Rate Factor	1.00	1.00	1.04	1.20
Systemic Vascular Resistance Factor	1.00	0.70	0.65	0.50
Systemic Arteries Compliance Factor	1.00	1.00	1.55	1.25
Pulmonary Arteries Compliance Factor	1.00	1.00	1.25	1.15

Idiopathic Hypotension Vital Signs

Approximate vital signs after one to two minutes in state

	Reset	Mild	Moderate	Severe
Heart Rate (HR)	71	72	75	80
Blood Pressure (BP)	118/77	105/63	94/63	85/50
Mean Arterial Pressure (MAP)	93	80	74	63
Cardiac Output (CO)	5.2	5.5	5.4	5.5
Respiratory Rate (RR)	13	13	13	13
Oxygen Saturation (SpO_2)	98	98	98	98
Partial Pressure of Carbon Dioxide ($PaCO_2$)	41	41	41	41

Acute Hypercapnia

The essential mechanism underlying all causes of hypercapnia is inadequate alveolar ventilation. Potential contributing factors include increased carbon dioxide production, decreased minute ventilation, increased airway resistance and inefficiency of alveolar gas exchange.[3] The most common causes are acute exacerbations of asthma and chronic obstructive pulmonary disease (COPD). This condition is programmed as an acute increase in total body carbon dioxide concentration, as might occur in trauma or after tourniquet removal.

NOTE: When using patients with acute hypercapnia, it is recommended to stop the patient, restart the patient and reconnect to the mannequin when moving between states.

Acute Hypercapnia Parameter Adjustments

	Reset	Borderline	Mild	Moderate	Severe	Profound	Extreme
O_2 Consumption	250	275	300	310	320	320	320
CO_2 Production Factor	1.00	1.40	2.00	2.90	3.20	3.40	3.60
$PaCO_2$ Set-point	40.0	44.0	48.0	51.0	55.0	59.0	63.0
Venous CO_2 Shift	0.0	5.0	10.0	15.0	20.0	25.0	30.0
Respiratory Gain Factor	1.00	0.10	0.10	0.10	0.10	0.10	0.10
Respiratory Rate Factor	1.00	1.35	1.80	2.25	2.70	3.20	3.70
Tidal Volume Factor	1.00	1.25	1.20	1.20	1.20	1.20	1.25

Acute Hypercapnia Vital Signs

Approximate vital signs after five to 10 minutes in state

	Reset	Borderline	Mild	Moderate	Severe	Profound	Extreme
Heart Rate (HR)	71	70	70	70	70 to 81	70 to 81	70 to 122
Blood Pressure (BP)	118/77	118/77	118/77	118/77	106 to 118/ 77 to 86	106 to 118/ 77 to 86	105 to 121/80 to 87
Mean Arterial Pressure (MAP)	93	93	93	93	93	93	93
Cardiac Output (CO)	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Respiratory Rate (RR)	13 to 14	14 to 15	19 to 20	24 to 25	28 to 30	31 to 35	36 to 40
Oxygen Saturation (SpO_2)	98	98	98	98	98	98	98
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40 to 41	43 to 45	46 to 49	50 to 52	52 to 56	54 to 61	57 to 65

Chronic Obstructive Pulmonary Disease (COPD)/Emphysema

Obstructive lung disease describes obstruction to the flow of air through the airways and is characterized by decreased air flow rates during expiration. It is often accompanied by an elevated functional residual capacity resulting from trapped gas. COPD is the term applied to both emphysema and chronic bronchitis, diseases usually caused by cigarette smoking or other chronic irritant inhalation.[4]

COPD/Emphysema Parameter Adjustments

	Reset	Mild	Moderate	Severe	Very Severe
Baroreceptor Maximum Pressure	112	140	145	150	160
Baroreceptor Minimum Pressure	72	80	85	90	97
Baroreceptor Gain (Overall) Factor	1.00	1.00	1.00	1.00	1.00
Heart Rate Factor	1.00	1.00	1.10	1.15	1.20
Right Ventricle Contractility Factor	1.00	1.50	1.30	1.20	1.20
Systemic Vasculature Resistance Factor	1.00	1.00	1.15	1.10	1.20
Pulmonary Vasculature Resistance Factor	1.00	1.00	1.05	1.10	1.15
Systemic Arteries Compliance Factor	1.00	0.75	0.50	0.50	0.50
Pulmonary Arteries Compliance Factor	1.00	0.75	0.50	0.50	0.50
Respiratory Rate Factor	1.00	1.05	1.10	1.20	1.35
Tidal Volume Factor	1.00	0.70	0.60	0.55	0.50
Volume/Rate Control Factor	1.0	0.7	0.7	0.7	0.7
I to E Ratio (1:X)	2.0	2.3	2.6	2.8	3.2
Shunt Fraction	0.02	0.18	0.30	0.38	0.44
Lung Compliance Factor: Left	1.00	1.50	1.50	1.50	1.50
Lung Compliance Factor: Right	1.00	1.50	1.50	1.50	1.50
Functional Residual Capacity	2300	2400	2500	2600	2700

COPD/Emphysema Vital Signs

Approximate vital signs after five to 10 minutes in state

	Reset	Mild	Moderate	Severe	Very Severe
Heart Rate (HR)	71	85	94	104	110
Blood Pressure (BP)	118/77	137/91	148/98	156/100	161/107
Mean Arterial Pressure (MAP)	93	110	122	123	130
Pulmonary Artery Pressure (PAP)	20/8	24/8	25/8	28/8	27/9
Pulmonary Capillary Wedge Pressure (PCWP)	4	5	5	5	5
Cardiac Output (CO)	5.2	6.2	6.2	6.5	6.5
Respiratory Rate (RR)	13	18	22	26	31
Tidal Volume (V_T)	570	550	545	510	520
Oxygen Saturation (SpO_2)	98	95	91	88	85
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40 to 41	39 to 44	38 to 39	38 to 39	39 to 40

Tension Pneumothorax (Left or Right)

Pneumothorax is the result of accumulation of air or fluid in the pleural space. Tension pneumothorax occurs when the accumulated fluid creates a positive pressure in the pleural space, thereby exerting pressure on the great veins in the thorax and impairing venous return. The result is obstructive shock secondary to obstruction of the blood flow within the cardiovascular circuit. The results are hypotension, decreased cardiac output, increased arteriovenous oxygen difference and decreased myocardial oxygen consumption.[3]

Lung compliance and chest wall compliance decrease with increasing volume within the pleural space (intrapleural volume). In Müse, the **Chest Wall Capacity** parameter sets the total (combined) intrapleural and lung volumes at which the chest wall is considered distended. There should be a reduction in **Chest Wall Capacity** with a tension pneumothorax.

Tension Pneumothorax (Left) Parameter Adjustments

	Reset	Mild	Moderate	Severe	Extreme
Shunt Fraction	0.02	0.15	0.28	0.40	0.50
Intrapleural Volume (Left)	0	300	600	1500	2000
Lung Compliance Factor (Left)	1.00	0.75	0.50	0.25	0.15
Lung Compliance Factor (Right)	1.00	1.00	1.00	1.00	0.60
Distended Chest Wall Compliance Factor	1.00	0.75	0.50	0.25	0.15
Chest Wall Capacity	3900	3900	3600	3300	3200

Tension Pneumothorax (Left) Vital Signs

Approximate vital signs after two to three minutes in state

	Reset	Mild	Moderate	Severe	Extreme
Heart Rate (HR)	71	79	88	103	139
Blood Pressure (BP)	118/77	118/80	115/81	103/76	78/65
Mean Arterial Pressure (MAP)	93	94	94	89	70
Pulmonary Arterial Pressure (PAP)	20/8	20/9	22/11	26/18	35/23
Central Venous Pressure (CVP)	1	2	5	12	30
Cardiac Output (CO)	5.2	5.3	5.3	4.4	2.2
Respiratory Rate (RR)	13	20	24	33	35
Oxygen Saturation (SpO_2)	98	96	92	83	76
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40 to 41	34 to 35	31 to 32	40 to 41.	40 to 41

Tension Pneumothorax (Right) Parameter Adjustments

	Reset	Mild	Moderate	Severe	Extreme
Shunt Fraction	0.02	0.15	0.28	0.40	0.50
Intrapleural Volume (Right)	0	300	600	1500	2000
Lung Compliance Factor (Right)	1.00	0.75	0.50	0.25	0.15
Lung Compliance Factor (Left)	1.00	1.00	1.00	1.00	0.60
Distended Chest Wall Compliance Factor	1.00	0.75	0.50	0.25	0.15
Chest Wall Capacity	3900	3900	3600	3300	3300

Tension Pneumothorax (Right) Vital Signs

Approximate vital signs after two to three minutes in state

	Reset	Mild	Moderate	Severe	Extreme
Heart Rate (HR)	71	79	88	103	139
Blood Pressure (BP)	118/77	118/80	115/81	103/76	78/65
Mean Arterial Pressure (MAP)	93	94	94	89	70
Pulmonary Arterial Pressure (PAP)	20/8	20/9	22/11	26/18	35/23
Central Venous Pressure (CVP)	1	2	5	12	30
Cardiac Output (CO)	5.2	5.3	5.3	4.4	2.2
Respiratory Rate (RR)	13	20	24	33	35
Oxygen Saturation (SpO_2)	98	96	92	83	76
Partial Pressure of Carbon Dioxide ($PaCO_2$)	40 to 41	34 to 35	31 to 32	40 to 41	40 to 41

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Appendix B – Müse Parameter Descriptions

The Müse software has a number of parameters that control the physiological features of the HPS. The parameters are grouped by category: Neurological, Respiratory, Cardiovascular, Fluids and Sounds. Each screen lists the Basic parameters by default. However, when the **Basic/ Additional** switch is activated, additional parameters become available.

Click the **Basic** switch to see **Additional** parameters
Basic
Additional
Click the **Additional** switch to return to the **Basic** parameters

The Basic/Additional Switch

The following is a brief description of each parameter. Each parameter description lists the default settings for the Stan D. Ardman and Norma L. Female patients as well as the ranges, if available, for all patients.

Neurological

The HPS can simulate a variety of neurological clinical indicators, such as secretions and reactive eyes.

Neurological Parameters
Eyes: Pupil Size
Eyes: Blinking
Convulsions
ICP
NMB
Temperature: Body
Temperature: Blood

Eyes

Each eye has reactive pupils and eyelids that blink and close.

Eyes: Pupil Diameter

These parameters are used to control the diameter of the pupils in the eyes. Each eye has reactive pupils and functional eyelids that blink.

Currently, there are four pupil options that are used to control the diameter of the pupils in both eyes: **Modeled**, **Reactive, Blown** or a Fixed Pupil Size (2 mm to 8 mm).

When the Eyes are set to **Reactive**, the pupils re-size in response to changes in lighting condition. If both pupils are set to **Reactive**, both pupils re-size in a consensual manner.

If the Eyes are set to **Modeled**, the pupil size is driven by the pharmacology of morphine. In this mode, the baseline pupil size is 4.7 mm. With increasing effector site concentration of morphine, the pupils constrict (up to a maximum constriction of 2.8 mm). A dose of 4.6 mg of morphine results in 50% of the maximum effect (a pupil size of 3.75 mm). The reactivity to light is absent for this option and is only available in the **Reactive** mode. Presently, when the **Modeled** option is selected, only morphine has an effect on pupil size. The pupillary response to other drugs can be made "on the fly" or scripted using the Scenario Designer.

Other settings allow the user to fix one or both pupils to a specific size.

Default: Reactive

Eyes: Blinking

In **Auto** mode, the eyelids are normally blinking under the following conditions: Minute Ventilation is greater than 1500 mL, SpO_2 is greater than 70% and neuromuscular blockade (NMB) is less than 30%.

The **Blinking** and **Closed** settings allow the user to have one or both eyes either blinking or closed and override the automatic response.

Default: Auto

The **Slow**, **Normal** and **Fast** parameters control the eyelid blinking frequency. Presently, blinking frequency is not linked to the physiological models. However, the response can be done "on the fly" or scripted using the Scenario Designer.

Default: Normal

Convulsions

The **Convulsions** parameter is used to simulate the presence of convulsions. They are either **On** or **Off**.

Default: Off

Intracranial Pressure (ICP)

The ICP parameter is used to set the ICP displayed as a numeric value on the TouchPro monitor and the patient monitor. The base value is set at 8 mmHg. This parameter is uninfluenced by physiological models.

Default: 8 mmHg

Range: 0 mmHg - 65.0 mmHg

Neuromuscular Blockade (NMB)

The pharmacokinetic and pharmacodynamic models based on the neuromuscular blocking agents administered and the time course of their injection automatically determines the degree of NMB. For some educational applications, however, the instructor may wish to set a fixed degree of neuromuscular blockade that remains stable for an indefinite period. This can be accomplished using the **NMB** parameter. The default setting instructs the pharmacologic models to determine the degree of neuromuscular blockade based upon the drugs injected and their pharmacologic properties.

When a positive numeric value is assigned to this parameter, the degree of NMB is set to that level. For example, 80% NMB causes the simulator to set the degree of NMB to 80%, regardless of the presence (or absence) of neuromuscular blocking drugs. Clinically, the spontaneous tidal volume is markedly reduced.

Default: Modeled

Range: 0% - 100%

NOTE: Setting **NMB** to 100% in Müse for PediaSIM HPS does NOT cause asystole. To achieve a negative cardiovascular response in PediaSIM HPS patients, set **NMB** to 100% and use the **Cardiac Rhythm** parameters.

Temperature: Body

The temperature measured at the body surface can be set using this parameter and can be displayed on the Patient Status Display and TouchPro software.

The body temperature is not linked to the physiologic models. However, changes can be made "on the fly" or scripted using the Scenario Designer.

Default: 36.5° C

Range: 32.0° C - 42.0° C

Temperature: Blood

The arterial blood temperature can be set using the **Temperature: Blood** parameter. The arterial blood temperature can then be displayed on the Patient Status Display and TouchPro software. Note that changes in arterial temperature may alter the position of the standard oxyhemoglobin dissociation curve (shift). As temperature increases or pH decreases, more oxygen is released from hemoglobin and thus the patient's saturation decreases. The inverse is also true.

Default: 37° C

Range: 32.0° C - 42.0° C

Respiratory – Basic Parameters

Respiratory Parameters – Basic
Swollen Tongue
Airway Occluder
Laryngospasm
Needle Decompression
Bronchial Occlusion (Left and Right)
Respiratory Rate
Respiratory Rate Factor
Shunt Fraction
SpO_2
NMB
Tidal Volume
Intrapleural Volume: Left Intrapleural Volume: Right
Fraction of Inspired O_2
Chest Tube Flow

Swollen Tongue

This parameter is used to create two degrees of tongue swelling: **Semi-Swollen** and **Swollen**. The **Not Swollen** setting returns the tongue to its normal anatomic state.

Default: Not Swollen

Range: Not Swollen, Semi-Swollen and Swollen

Airway Occluder

Using the **Airway Occluder** parameter, swelling of the posterior oropharynx can be activated to limit the view of the larynx and hinder intubation but allow mask ventilation of the patient's lungs, thereby creating a "cannot intubate, can ventilate" scenario.

Default: Off

Laryngospasm

Use the **Laryngospasm** parameter to simulate a laryngospasm. A laryngospasm actuator closes the patient's vocal cords and prevents both ventilation and intubation.

Default: Off

Needle Decompression

The **Needle Decompression** parameter is used to activate the **Needle Decompression** hardware in the simulator to relieve a pneumothorax in the simulator. This causes a rush of air to be heard on successful decompression. The amount of decompression is automatically subtracted from the **Intrapleural Volume** set.

Default: Off

NOTE: The **Chest Tube** and **Needle Decompression** features cannot be enabled simultaneously.

Bronchial Occlusion (Left and Right)

Turning on the **Bronchial Occlusion** parameter completely obstructs the right or left bronchi, simulating a lower airway obstruction (e.g., mucus plug). Right and left bronchi can be occluded individually.

Default: Off

Respiratory Rate

The **Respiratory Rate** parameter is used to set the respiratory rate to a given number of breaths per minute. Once set, arterial oxygen and carbon dioxide values have no effect on the resulting respiratory rate, but continue to influence other components of the physiological models. The patient continues to breathe at the set number of breaths-per-minute, regardless of the arterial oxygen or carbon dioxide levels.

For example, when the respiratory rate is set to 10 breaths per minute, the respiratory rate remains at 10 breaths per minute, regardless of arterial oxygen or carbon dioxide levels. In such situations, the patient can only respond to arterial oxygen or carbon dioxide levels by adjusting the **Tidal Volume** parameter.

Default: Modeled

Range: 4 breaths per minute - 40 breaths per minute

Respiratory Rate Factor

The **Respiratory Rate Factor** parameter is used to change the baseline respiratory rate (before the control-of-breathing and drug influences are taken into account.) The standard baseline respiratory rate is 11 to 13 breaths per minute. A **Respiratory Rate Factor** value of 2 doubles the baseline respiratory rate. A value of 0.5 decreases the baseline respiratory rate by 50%.

Default: 1

Range: 0.01 - 6.00

TIP: First decrease the respiratory gain factor to reduce the influence of the respiratory control mechanism on the respiratory rate and tidal volume.

Shunt Fraction

The **Shunt Fraction** parameter is frequently used to assist in desaturating a patient. This parameter creates a physiologic "bypass" of the normal pulmonary circulation, resulting in changes in O_2, CO_2 and anesthetic gases at the alveolar level. Typically, values of 0.1 to 0.4 are needed to create large alveolar-arterial oxygen gradients sufficient to cause arterial hypoxemia.

Default: 0.02

Range: 0.00 - 0.50

TIP: If the parameter is set high (0.5), the patient desaturates rapidly and responds negatively to the administration of supplemental O_2.

SpO_2

The SpO_2 parameter is used to override the normal pulmonary circulation and set the SpO_2 at a fixed numeric value, regardless of the oxygen applied. Resetting to **Modeled** returns control of the underlying SpO_2 to the physiological models.

Default: Modeled

Range: 0% - 100%

Neuromuscular Blockade (NMB)

The pharmacokinetic and pharmacodynamic models based on the neuromuscular blocking agents administered and the time course of their injection automatically determines the degree of NMB. For some educational applications, however, the instructor may wish to set a fixed degree of neuromuscular blockade that remains stable for an indefinite period. This can be accomplished using the **NMB** parameter. The default setting instructs the pharmacologic models to determine the degree of neuromuscular blockade based upon the drugs injected and their pharmacologic properties.

When a positive numeric value is assigned to this parameter, the degree of NMB is set to that level. For example, 80% NMB causes the simulator to set the degree of NMB to 80%, regardless of the presence (or absence) of neuromuscular blocking drugs. Clinically, the spontaneous tidal volume is markedly reduced.

Default: Modeled

Range: 0% - 100%

Tidal Volume

The **Tidal Volume** parameter is used to set the tidal volume to a given volume per breath. Once Tidal Volume is set to a numeric value, arterial oxygen and carbon dioxide values have no effect on the tidal volume, but continue to influence other components of the physiological models.

For example, with the tidal volume set to 600 mL in the adult simulator, the tidal volume remains a constant (set) 600 mL even in the event of falling arterial oxygen levels. In such situations, the patient can only respond to arterial oxygen or carbon dioxide levels when the respiratory rate is adjusted.

Default: Modeled

Range: 0 mL- 2500 mL

Intrapleural Volume (Vol): (Left and Right)

The **Intrapleural Vol** parameters allow intrapleural volume to accumulate, for example, as happens during pneumothorax, hydrothorax or hemothorax.

To simulate a pneumothorax, set the corresponding **Intrapleural Vol** to a value greater than 0 mL. Values more than 1500 mL reduce the corresponding lung volume significantly. The breath sounds are automatically diminished on the appropriate side due to decreased ventilation of the affected lung.

Default: 0

Range: 0 mL - 2500 mL

Fraction of Inspired O_2 (FiO_2)

This parameter is used to simulate changes in the **FiO_2,** such as would occur with the administration of supplemental oxygen. Use this parameter to simulate supplemental oxygen when using HPS with Müse SCE Development Software. When using the HPS with Müse Instructor Workstation while connected to the HPS mannequin, the FiO_2 value is overridden by the value measured in the lung.

Default: 21%

Range: 0% - 100%

Chest Tube Flow

The **Chest Tube Flow** parameter is used with the chest tube feature of the simulator. The selected **Chest Tube Flow** rate results in a corresponding **Intrapleural Volume** decrease.

Default: 50 mL/min

Range: 0 mL/min - 100 mL/min

Respiratory – Additional Parameters

Respiratory Parameters – Additional
Respiratory Rate
Tidal Volume
Tidal Volume Factor
pH Shift
PEEP
Chest Tube
Chest Tube Flow
Chest Tube Air Leak
O_2 Consumption
CO_2 Production Factor
$PaCO_2$ Set-point
PaO_2 Set-point
I to E Ratio (1:X)
$PetCO_2$-$PaCO_2$ Factor
Respiratory Gain Factor
Respiratory Quotient
Volume/Rate Control Factor
Chest Wall Capacity
Chest Wall Compliance Factor
Distended Chest Wall Compliance Factor
Functional Residual Capacity
Lung Compliance Factor: Left Lung Compliance Factor: Right
Venous CO_2 Shift
Bronchial Resistance Factor: Left Bronchial Resistance Factor: Right
Alveolar Enflurane
Fraction of Inspired Enflurane
Alveolar Halothane
Fraction of Inspired Halothane
Alveolar Isoflurane
Fraction of Inspired Isoflurane
Alveolar Nitrous Oxide
Fraction of Inspired Nitrous Oxide
Alveolar Sevoflurane
Fraction of Inspired Sevoflurane

Respiratory Rate

The **Respiratory Rate** parameter is used to set the respiratory rate to a given number of breaths per minute. Once set, arterial oxygen and carbon dioxide values have no effect on the resulting respiratory rate, but continue to influence other components of the physiological models. The patient continues to breathe at the set number of breaths-per-minute, regardless of the arterial oxygen or carbon dioxide levels.

For example, when the respiratory rate is set to 10 breaths per minute, the respiratory rate remains at 10 breaths per minute, regardless of arterial oxygen or carbon dioxide levels. In such situations, the patient can only respond to arterial oxygen or carbon dioxide levels by adjusting the **Tidal Volume** parameter.

Default: Modeled

Range: 4 breaths per minute - 40 breaths per minute

Tidal Volume

The **Tidal Volume** parameter is used to set the tidal volume to a given volume per breath. Once tidal volume is set to a numeric value, arterial oxygen and carbon dioxide values have no effect on the tidal volume, but continue to influence other components of the physiological models.

For example, with the tidal volume set to 600 mL in the adult simulator, the tidal volume remains a constant (set) 600 mL even in the event of falling arterial oxygen levels. In such situations, the patient can only respond to arterial oxygen or carbon dioxide levels when the respiratory rate is adjusted.

Default: Modeled

Range: 0 mL- 2500 mL

Tidal Volume Factor

The **Tidal Volume Factor** parameter is used to change the baseline tidal volume (before the control-of-breathing and drug influences are taken into account.) The standard baseline tidal volume is 500 to 600 mL. A **Tidal Volume Factor** value of 2 doubles the baseline tidal volume. A value of 0.5 decreases the baseline tidal volume by 50%.

Default: 1

Range: 0.10 - 4.00

TIP: First decrease the **Respiratory Gain Factor** parameter to reduce the influence of the respiratory control mechanism on the tidal volume.

pH Shift

The **pH Shift** parameter is used to create a metabolic acidosis or metabolic alkalosis under script control.

The default pH value displayed on the Patient Status Display or TouchPro software is dependent on respiratory arterial CO_2 values. Under default conditions ($PaCO_2$ = 40 mmHg), the pH is approximately 7.4. Rising arterial CO_2 produces a subsequent drop in pH, while falling arterial CO_2 levels result in rising pH values.

To simulate pH changes with metabolic changes (acidosis or alkalosis), the **pH Shift** value is a mathematical addition to (or subtraction) from the displayed pH value to that which is desired.

Default: 0

Range: -(0.50) - 0.50

Positive End Expiratory Pressure (PEEP)

The **PEEP** parameter specifies the amount of positive end expiratory pressure applied during mechanical ventilation. Setting this parameter results in clinically appropriate intrathoracic pressures and hemodynamic responses.

Default: 0 cmH_2O

Range: 0.0 cmH_2O - 25.0 cmH_2O

Chest Tube

The **Chest Tube** parameter is used to activate the chest tube hardware in the simulator. The **Prime** option has no physiologic impact. Instead, it is used to prepare the feature by allowing fluid to flow through the apparatus, thereby removing air from the line.

When a chest tube is placed into the simulator, this is sensed and recorded in the Event Log. It is also possible to have a scenario transition on chest tube placement, which can be scripted using the Scenario Designer.

Default: Disable

NOTE: The **Chest Tube** and **Needle Decompression** features cannot be enabled simultaneously.

Chest Tube Flow

The **Chest Tube Flow** parameter is used with the chest tube feature of the simulator. The Chest Tube Flow specifies the rate at which fluid can be removed from the simulated pleural space via a chest tube drainage system. As the chest tube drains, the volume is automatically subtracted from the set amount of Intrapleural Volume.

Default: 50 mL per minute

Range: 0 mL per minute - 100 mL per minute

Chest Tube Air Leak

The **Chest Tube Air Leak** parameter is used with the chest tube feature. A setting of 100% allows only air to be removed via the chest tube, while a setting of 0% allows only fluid to be removed. Settings between 0 and 100% create a mixture of air and fluid.

Default: 0%

Range: 0% to 100%

O_2 Consumption

The **O_2 Consumption** parameter is used to change the rate of consumption of oxygen and production of carbon dioxide. When **O_2 Consumption** is increased and used with increased **Shunt Fraction**, profound levels of hypoxia can be achieved rapidly.

Default: 250 mL per minute

Range: 0 mL per minute - 2000 mL per minute

CO_2 Production Factor

The **CO_2 Production Factor** parameter allows for the manipulation of metabolic CO_2 production to simulate a variety of pathophysiological conditions. CO_2 production is determined by the **O_2 Consumption** and **Respiratory Quotient** settings. A CO_2 Production Factor value of 2 doubles the CO_2 production, while a value of 0.5 decreases the CO_2 production by 50%.

Default: 1

Range: 0.50 - 4.00

$PaCO_2$ Set-point

The **$PaCO_2$ Set-point** parameter is a set point for $PaCO_2$. The control-of-breathing model adjusts tidal volume and respiratory rate in order to bring the $PaCO_2$ toward this set point. Factors that influence the success of this control effort include baseline tidal volume, baseline respiratory rate, respiratory gain, O_2 consumption, respiratory quotient, lung compliances, chest wall compliance, bronchial resistances, the presence of artificial airways in the simulator and the inspired gas mixture.

When the **$PaCO_2$ Set-point** is set to a new value, the physiological controls adjust the simulator's respiratory pattern in an attempt to attain the desired set point. For example, when the set point is raised from 40 to 50 mmHg, there is a transitory decrease in respiratory rate and tidal volume, as the physiological controls attempt to drive the $PaCO_2$ toward 50 mmHg. When the $PaCO_2$ reaches the new set point, the simulator's respiratory rate and tidal volume are again controlled to maintain the $PaCO_2$ at the new set point.

Default: 40 mmHg

Range: 20.0 mmHg - 70.0 mmHg

PaO_2 Set-point

The **PaO_2 Set-point** parameter is a set point for PaO_2. When PaO_2 is below the set point value, progressive stimulation of spontaneous minute ventilation occurs. Both tidal volume and respiratory rate rise, which under appropriate conditions results in PaO_2 moving closer to the set point. Factors that influence this control effort include baseline tidal volume, baseline respiratory rate, respiratory gain, O_2 consumption, respiratory quotient, lung compliances, chest wall compliance, bronchial resistances, the presence of artificial airways in the simulator and the inspired gas mixture. Minute ventilation is not affected for PaO_2 above the set point.

For example, if **PaO_2 Set-point** is set to 100 mmHg and PaO_2 drops to 90 mmHg, ventilatory stimulation occurs. When the PaO_2 reaches the new set point, the simulator's respiratory rate and tidal volume are again controlled to maintain $PaCO_2$ at the $PaCO_2$ set point (*see **$PaCO_2$ Set-point** on page B-14 for more information*).

Default: 100.00 mmHg

Range: 20.0 mmHg - 100.0 mmHg

I to E Ratio (1:X)

The **I to E Ratio (1:X)** parameter sets the inspiratory-expiratory (I:E) ratio for spontaneous ventilation. At the default setting, the time for exhalation is twice that of inhalation.

Default: 2

Range: 0.5 - 7.0

$PetCO_2$- $PaCO_2$ Factor

The **$PetCO_2$-$PaCO_2$ Factor** adjusts the end-tidal CO_2 relative to the $PaCO_2$. At the default value of 1, $PetCO_2$ very closely approximates $PaCO_2$. When **$PetCO_2$- $PaCO_2$ Factor** is set at a value of 2, $PetCO_2$ is approximately one half of $PaCO_2$. $PetCO_2$ depends on CO_2 production and alveolar ventilation. The use of the Onset feature (e.g., onset over 1 minute) is recommended for this parameter.

Default: 1

Range: 0.9 -10.0

Respiratory Gain Factor

The **Respiratory Gain Factor** determines how strong an influence arterial CO_2 levels have on the simulated patient's tidal volume and respiratory rate. Under default conditions (value = 1), when arterial CO_2 levels rise, the patient's respiratory rate and tidal volume show a transitory increase in an attempt to return the patient to the physiological control CO_2 set-point. If the **Respiratory Gain Factor** is increased to more than 1, the patient has a more pronounced response, while values less than 1 correspond to a blunted response.

Default: 1

Range: 0.00 - 10.00

Respiratory Quotient

Respiratory Quotient is the rate of carbon dioxide production divided by the rate of oxygen consumption. Changes to the **Respiratory Quotient** parameter alter the rate of carbon dioxide production relative to the rate of oxygen consumption.

Default: 0.8

Range: 0.70 - 1.10

Volume/Rate Control Factor

Ventilatory responses to increased arterial carbon dioxide or decreased arterial oxygen may take the form of increased tidal volume, increased respiratory rate, or both. The volume/rate control factor determines these relative changes. At a value of 1, increased and decreased ventilatory drive affect tidal volume and respiratory rate equally. When volume/rate control is greater than 1, increased or decreased minute ventilation is predominantly achieved by changes in tidal volume. When the volume/rate control factor is less than 1, ventilatory changes are affected primarily by changes in respiratory rate.

For example, set the volume/rate control factor to 0.1 and increase the shunt fraction to 0.4 to decrease the arterial O_2. The patient responds to falling arterial oxygen levels with increased minute ventilation. Increasing the respiratory rate with minimal increase in tidal volume produces this.

Default: 1 mL

Range: 0.1 mL - 10.0 mL

Chest Wall Capacity

The **Chest Wall Capacity** parameter sets the total (combined) intrapleural and lung volumes at which the chest wall is considered distended. Also, see **Chest Wall Compliance Factor** and **Distended Chest Wall Compliance Factor**.

Default: 3900

Range: 1500 - 3900

Chest Wall Compliance Factor

This **Chest Wall Compliance Factor** parameter describes the interaction of the chest wall with the lungs. The **Chest Wall Compliance Factor** parameter defines the volume-pressure relationship in the normal operating lung volumes. Once distended, however, the chest wall rapidly becomes much less compliant (i.e., much "stiffer") and resistant to further inflation.

Default: 1

Range: 0.15 - 10.00

Distended Chest Wall Compliance Factor

The **Distended Chest Wall Compliance Factor** parameter, along with the **Chest Wall Compliance Factor** parameter, describes the interaction of the chest wall with the lungs. The **Chest Wall Compliance Factor** parameter defines the volume-pressure relationship in normal lung volumes. Once distended, however, the chest wall rapidly becomes much "stiffer" and resistant to further inflation. Also, see **Chest Wall Compliance Factor**.

The **Distended Chest Wall Compliance Factor** parameter must be set to a low value for increased intrapleural volumes to result in elevated inspiratory pressures with positive pressure ventilation. Also, see **Intrapleural Volume (Vol): Left** or **Intrapleural Volume (Vol): Right** parameters.

Default: 1

Range: 0.10 - 10.00

Functional Residual Capacity

The **Functional Residual Capacity** parameter sets the combined left and right lung volume remaining at the end of a normal, spontaneous exhalation. This parameter influences the speed of desaturation during apnea.

Default: 2300 mL

Range: 500 mL- 4000 mL

Lung Compliance Factor: (Left and Right)

These two parameters independently set the left and right lung compliance. **Lung Compliance Factor** determines how easily the lungs inflate. Low compliance factors (less than 1) create "stiff" lungs (such as in acute respiratory distress syndrome or pulmonary edema) requiring more pressure for expansion. High compliance factors (greater than 1) create "loose" lungs that easily inflate with less pressure.

Default: 1

Range: 0.15 - 10.00

Venous CO_2 Shift

The **Venous CO_2 Shift** parameter affects the partial pressure of CO_2 in the venous blood. Changing this parameter allows large and rapid shifts in total body CO_2 concentration. Increases in alveolar and arterial CO_2 follow rapidly in a physiologically correct magnitude and time course.

This parameter is useful for giving a "bolus" of CO_2 to the venous system. The alveolar and arterial CO_2 levels rise rapidly in response to the added carbon dioxide but soon returns to "pre-bolus" levels as increased ventilation efforts work to eliminate the added CO_2. Therefore, the rise in CO_2 levels is only transitory. This parameter can be used to simulated external CO_2 administration such as that used during laparoscopy.

NOTE: This parameter is only intended to be used while running an SCE. SCEs and patients should NOT be saved once the parameter has been applied. If an SCE or patient is saved after the **Venous CO_2 Shift** parameter has been applied, unexpected behavior may occur when the SCE or patient is reloaded.

Default: 0 mmHg

Range: 0.0 mmHg - 60.0 mmHg

Bronchial Resistance Factor (Left and Right)

The **Bronchial Resistance Factor** parameter can be used to set the rate of left and right bronchial resistance individually. The rate of resistance can also be set to occur over time.

Default: 1 cmH_2O

Range: 0.0 cmH_2O - 250,000.0 cmH_2O

Alveolar Enflurane

The **Alveolar Enflurane** parameter is used to simulate the presence of enflurane in the alveolar space without using real anesthetic vapors. The enflurane percentage is input to the drug models to achieve the expected pharmacodynamic effects (e.g., respiratory depression).

Using this parameter bypasses pharmacokinetics, real and instructor-specified inspired fractions, venous content, lung perfusion and ventilation. This parameter can be used to focus on cardiorespiratory effects (pharmacodynamics).

WARNING: Using this parameter may result in undesired behavior when switching between SCE Development Software and the Instructor Workstation.

IMPORTANT: Setting an alveolar fraction override on the Instructor Workstation causes the infusion pump to stop.

NOTE: Muse does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: Modeled

Range: 0.00% - 5.00%

Fraction of Inspired Enflurane

The **Fraction of Inspired Enflurane** parameter is used to simulate the amount of enflurane set in the anesthetic vaporizer and is used to calculate alveolar enflurane.

The **Fraction of Inspired Enflurane** parameter is only effective when used with SCE Development Software and should not be used with the Instructor Workstation. This parameter has a faster effect on physiology than anesthesia machine settings, because mixing in the breathing circuit is not simulated.

NOTE: Müse does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: 0%

Range: 0.00% - 5.00%

Alveolar Halothane

The **Alveolar Halothane** parameter is used to simulate the presence of halothane in the alveolar space without using real anesthetic vapors. The halothane percentage is input to the drug models to achieve the expected pharmacodynamic effects (e.g., respiratory depression).

Using this parameter bypasses pharmacokinetics, real and instructor-specified inspired fractions, venous content, lung perfusion and ventilation. This parameter can be used to focus on cardiorespiratory effects (pharmacodynamics).

WARNING: Using this parameter may result in undesired behavior when switching between SCE Development Software and the Instructor Workstation.

IMPORTANT: Setting an alveolar fraction override on the Instructor Workstation causes the infusion pump to stop.

NOTE: Muse does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: Modeled

Range: 0.00% - 5.00%

Fraction of Inspired Halothane

The **Fraction of Inspired Halothane** parameter is used to simulate the amount of halothane set in the anesthetic vaporizer and is used to calculate alveolar halothane.

The **Fraction of Inspired Halothane** parameter is only effective when used with SCE Development Software and should not be used with the Instructor Workstation. This parameter has a faster effect on physiology than anesthesia machine settings, because mixing in the breathing circuit is not simulated.

NOTE: Müse does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: 0%

Range: 0.00% - 5.00%

Alveolar Isoflurane

The **Alveolar Isoflurane** parameter is used to simulate the presence of isoflurane in the alveolar space without using real anesthetic vapors. The isoflurane percentage is input to the drug models to achieve the expected pharmacodynamic effects (e.g., respiratory depression).

Using this parameter bypasses pharmacokinetics, real and instructor-specified inspired fractions, venous content, lung perfusion and ventilation. This parameter can be used to focus on cardiorespiratory effects (pharmacodynamics).

WARNING: Using this parameter may result in undesired behavior when switching between SCE Development Software and the Instructor Workstation.

IMPORTANT: Setting an alveolar fraction override on the Instructor Workstation causes the infusion pump to stop.

NOTE: Muse does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: Modeled

Range: 0.00% - 5.00%

Fraction of Inspired Isoflurane

The **Fraction of Inspired Isoflurane** parameter is used to simulate the amount of isoflurane set in the anesthetic vaporizer and is used to calculate alveolar isoflurane.

The **Fraction of Inspired Isoflurane** parameter is only effective when used with SCE Development Software and should not be used with the Instructor Workstation. This parameter has a faster effect on physiology than anesthesia machine settings, because mixing in the breathing circuit is not simulated.

NOTE: Müse does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: 0%

Range: 0.00% - 5.00%

Alveolar Nitrous Oxide

The **Fraction of Inspired Nitrous Oxide** parameter is used to simulate the amount of enflurane set in the anesthetic vaporizer and is used to calculate alveolar enflurane.

Using this parameter bypasses pharmacokinetics, real and instructor-specified inspired fractions, venous content, lung perfusion and ventilation. This parameter can be used to focus on cardiorespiratory effects (pharmacodynamics).

WARNING: Using this parameter may result in undesired behavior when switching between SCE Development Software and the Instructor Workstation.

IMPORTANT: Setting an alveolar fraction override on the Instructor Workstation causes the infusion pump to stop.

NOTE: Muse does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: Modeled

Range: 0.00% - 80.0%

Fraction of Inspired Nitrous Oxide

The **Fraction of Inspired Nitrous Oxide** parameter is used to simulate the amount of nitrous oxide set in the anesthetic vaporizer and is used to calculate alveolar nitrous oxide.

The **Fraction of Inspired Nitrous Oxide** parameter is only effective when used with SCE Development Software and should not be used with the Instructor Workstation. This parameter has a faster effect on physiology than anesthesia machine settings, because mixing in the breathing circuit is not simulated.

NOTE: Müse does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: 0%

Range: 0.00% - 80.0%

Alveolar Sevoflurane

The **Alveolar Sevoflurane** parameter is used to simulate the presence of sevoflurane in the alveolar space without using real anesthetic vapors. The sevoflurane percentage is input to the drug models to achieve the expected pharmacodynamic effects (e.g., respiratory depression).

Using this parameter bypasses pharmacokinetics, real and instructor-specified inspired fractions, venous content, lung perfusion and ventilation. This parameter can be used to focus on cardiorespiratory effects (pharmacodynamics).

WARNING: Using this parameter may result in undesired behavior when switching between SCE Development Software and the Instructor Workstation.

IMPORTANT: Setting an alveolar fraction override on the Instructor Workstation causes the infusion pump to stop.

NOTE: Muse does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: Modeled

Range: 0.00% - 8.00%

Fraction of Inspired Sevoflurane

The **Fraction of Inspired Sevoflurane** parameter is used to simulate the amount of sevoflurane set in the anesthetic vaporizer and is used to calculate alveolar sevoflurane.

The **Fraction of Inspired Sevoflurane** parameter is only effective when used with SCE Development Software and should not be used with the Instructor Workstation. This parameter has a faster effect on physiology than anesthesia machine settings, because mixing in the breathing circuit is not simulated.

NOTE: Müse does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: 0%

Range: 0.00% - 8.00%

Cardiovascular – Basic Parameters

Cardiovascular Parameters – Basic
Blood Pressure
Heart Rate
Heart Rate Factor
Cardiac Rhythm
Arterial Catheter
Central Venous Catheter
PA Catheter
PA Balloon
Defib
Pacing Current
Pacing Rate
Pacing Capture Threshold
Cold Fluid Inject

Blood Pressure

The **Blood Pressure** parameter is used to override the physiological modeling for blood pressure. The systolic and diastolic blood pressures can both be set to fixed numeric values, regardless of interventions performed. Resetting the parameter to **Modeled** returns control of the underlying Blood Pressure to the physiological models.

Default: Modeled

Range: Systolic 20 mmHg - 300 mmHg

Diastolic 10 mmHg - 300 mmHg

Heart Rate

The **Heart Rate** parameter is used to set the heart rate to a given (fixed) number of beats per minute. Once the Heart Rate is set to a numeric value, administered drugs or intravascular volume changes have no effect on the heart rate, but continue to influence other components of the physiological models. Use this parameter to "fix" or set the heart rate to a specific number. Resetting the parameter to **Modeled** returns control of the heart rate to the physiological models.

Default: Modeled

Range: 30 beats per minute - 220 beats per minute

Heart Rate Factor

The **Heart Rate Factor** parameter is used to change the baseline heart rate before physiological controls are taken into account. A value of 2 doubles the baseline heart rate, while a value of 0.5 decreases the heart rate by 50%. Use this parameter to raise or lower the heart rate.

Default: 1

Range: 0.10 - 4.00

Cardiac Rhythm

The **Cardiac Rhythm** parameter is used to change the patient's underlying cardiac rhythm displayed on the Patient Status Display, TouchPro software or physiological monitor. To change the cardiac rhythm, click the **Cardiac Rhythm** parameter and select the desired rhythm from the available list. If a number appears following the cardiac rhythm on the list, this overrides the heart rate to the rate indicated, causing administered drugs and intravascular volume changes to have no effect on the heart rate.

Default: Modeled

Options: Modeled
Asystole
Atrial Enlargement, Left
Atrial Enlargement, Right
Atrial Fibrillation
Atrial Fibrillation: HR 120
Atrial Fibrillation: HR 80
Atrial Flutter with 2:1 AV Conduction
Atrial Flutter: HR 150
Atrial Tachycardia
AV Block, First-Degree
AV Block, Second-Degree - Mobitz I
AV Block, Second-Degree - Mobitz II
AV Block, Third-Degree
Bundle Branch Block, Incomplete Right
Bundle Branch Block: Left
Bundle Branch Block, Left with PVC 25%
Bundle Branch Block: Right
Hypercalcemia
Hyperkalemia
Hypertrophy, Biventricular
Hypertrophy, Left Ventricular
Hypertrophy, Right Ventricular
Hypocalcemia
Hypokalemia
Hypothermia
Junctional
Junctional: HR 50
Long QT Syndrome
Myocardial Infarction with LBBB
Myocardial Infarction, Anterior
Myocardial Infarction, Anterolateral

Myocardial Infarction, Inferior
Myocardial Infarction, Lateral
Myocardial Infarction, Posterior
Myocardial Infarction, Septal
Myocardial Ischemia: Mild
Myocardial Ischemia: Moderate
Myocardial Ischemia: Moderate with PVC 10%
Myocardial Ischemia: Severe
Paroxysmal Junctional Tachycardia
Paroxysmal Junctional Tachycardia: HR 130
Pericarditis
Premature Atrial Contraction
Premature Ventricular Contraction 10%
Premature Ventricular Contraction 25%
Pulseless Electrical Activity
Sinus
Sinus Bradycardia
Sinus Bradycardia: HR 40
Sinus Tachycardia
Sinus Tachycardia: HR 120
ST Elevation with Chest Pain
Torsade de Pointes
Trifascicular Block
Ventricular Fibrillation: Coarse
Ventricular Fibrillation: Fine
Ventricular Tachycardia
Ventricular Tachycardia: Pulseless
Ventricular Tachycardia: HR 151
Ventricular Tachycardia: Pulseless HR 151
Wellen's Syndrome
WPW Syndrome, Left Lateral Pathway

Arterial Catheter

The arterial pressure displayed on the Patient Status Display or TouchPro software is set using this parameter. A non-pulsatile, "zero" pressure signal is emitted when the **Atmosphere** position is selected and can be used to simulate zeroing a pressure transducer. This may also be used to remove the arterial pressure waveform, if desired. The **Left Ventricle** position is useful for simulating cardiac catheterization procedures, or for demonstrating left ventricular end-diastolic pressure and its relationship to pulmonary artery occlusion ("wedge") and central venous pressure.

Default: Peripheral Artery

Options: Atmosphere
Peripheral Artery
Left Ventricle

Central Venous Catheter

The venous pressure displayed on the Patient Status Display or TouchPro software is set using this parameter. A non-pulsatile, "zero" pressure signal is emitted when the **Atmosphere** position is selected and can be used to simulate zeroing a pressure transducer. This may also be used to remove the central venous pressure waveform, if desired (e.g., beginning of an SCE with an "unmonitored" patient).

Default: Right Atrium

Options: Atmosphere
Extrathoracic Vein
Intrathoracic Vein
Right Atrium

Pulmonary Artery (PA) Catheter

The pulmonary artery pressure displayed on the Patient Status Display or TouchPro software is set using this parameter. A non-pulsatile, "zero" pressure signal is emitted when the **Atmosphere** position is selected and can be used to simulate zeroing a pressure transducer. This may also be used to remove the pulmonary artery pressure waveform, if desired (e.g., beginning of an SCE with an "unmonitored" patient). The pulmonary artery catheter can be "floated" into position by sequencing through the right heart positions. This may also be scripted into a scenario using the Scenario Designer.

Default: Pulmonary Artery

Options: Atmosphere
Intrathoracic Vein
Right Atrium
Right Ventricle
Pulmonary Artery

PA Balloon

Inflation of the pulmonary artery catheter balloon is simulated by switching to the **Inflated** option of the **PA Balloon** parameter. The appropriate pulmonary artery occlusion or "wedge" waveform is then displayed on the Patient Status Display or TouchPro software.

Default: Deflated

Options: Deflated
Inflated

Defibrillation (Defib)

The **Defib** parameter is used to simulate a specified amount of energy discharged via an external cardiac defibrillator. Setting this parameter results in the characteristic spike in the ECG, followed by a return to the pre-defibrillation rhythm. **Defib** has no direct effect on the electrical conduction system of the heart. Thus, synchronized cardioversion may be done "on the fly" or scripted using the Scenario Designer.

Default: 0 Joules

Range: 0 Joules- 360 Joules

Pacing Current

The **Pacing Current** parameter is used to simulate a specified amount of current discharged via an external cardiac pacer. Setting this parameter results in the characteristic pacing signal on the ECG waveform when the pacing current is at or above the capture threshold. Also, see **Pacing Capture Threshold**.

Default: 0 mA

Range: 0 mA- 200 mA

Pacing Rate

The **Pacing Rate** parameter determines the cardiac rate (in beats/minute) when the pacing current is at or above the pacing capture threshold. Also, see **Pacing Current** and **Pacing Capture Threshold**.

Default: 80 beats per minute

Range: 0 beats per minute - 119 beats per minute

Pacing Capture Threshold

The **Pacing Capture Threshold** parameter determines the minimum pacing current necessary to pace the heart via an external cardiac pacer. Also see **Pacing Current**. Pacing current values below the pacing capture threshold have no effect on the patient's heart rate.

Default: 50 mA

Range: 0 mA - 119 mA

Cold Fluid Inject

The **Cold Fluid Inject** parameter is used to simulate the injection of 10 mL iced saline into the pulmonary artery catheter. The appropriate Thermodilution waveform and cardiac output measurement are then displayed on the Patient Status Display or TouchPro software.

Cardiovascular – Additional Parameters

Cardiovascular Parameters – Additional
Baroreceptor Maximum Pressure
Baroreceptor Minimum Pressure
Left Ventricle Contractility Factor
Right Ventricle Contractility Factor
Systemic Vascular Resistance Factor
Venous Capacity Factor
Systemic Arteries Compliance Factor
Pulmonary Arteries Compliance Factor
Pulmonary Vasculature Resistance Factor
Venous Return Resistance Factor
Baroreceptor Gain (Overall) Factor
Baroreceptor Gain (Cardiac) Factor
Baroreceptor Gain (Peripheral) Factor
Chest Compression Efficacy
Tamponade Volume
Ischemic Index Sensitivity
Ischemic Index Averaging
Aortic Valve Resistance Factor
Mitral Valve Resistance Factor
Pulmonic Valve Resistance Factor
Pericardiocentesis

Baroreceptor Maximum Pressure

Baroreceptor maximum pressure defines the mean arterial pressure (MAP) at which the baroreceptor inhibitory activity on the heart and systemic vasculature is maximal. When a simulated patient's MAP increases above baseline pressure, the baroreceptor response exerts greater inhibitory controls on the MAP (e.g., reduction in heart rate) in an attempt to return the MAP to the patient's baseline pressure. However, these controls have an upper limit, and this "maximum pressure" is defined as the baroreceptor maximum pressure.

In other words, as the MAP increases, the physiological controls (i.e., baroreceptor response) work to bring the pressure back toward baseline, primarily by reducing the heart rate. For every 5 mmHg increase in MAP, the heart rate may decrease by 2 beats per minute in an attempt to keep the MAP in check. However, there is an upper limit ("maximum pressure"), after which these controls are no longer effective. Once the MAP reaches the baroreceptor maximum pressure, there is no additional reduction in heart rate if the pressure continues to rise. For example, should the pressure continue to rise, the heart rate would not show a corresponding slowing.

The MAP set-point is exactly between baroreceptor maximum pressure and baroreceptor minimum pressure.

Default: 112 mmHg

Range: 40 mmHg - 220 mmHg

Baroreceptor Minimum Pressure

Baroreceptor minimum pressure defines the mean arterial pressure (MAP) at which the baroreceptor inhibitory activity on the heart and systemic vasculature is minimal. When a simulated patient's MAP decreases below baseline pressure, the baroreceptor response exerts inhibitory controls on the MAP (e.g., increase in heart rate) in an attempt to return the MAP to the patient's baseline pressure. However, these controls have a lower limit, and this "minimum pressure" is defined as the baroreceptor minimum pressure.

In other words, as the MAP decreases, the physiological controls (i.e., baroreceptor response) work to bring the pressure back toward baseline, primarily by increasing the heart rate. For every 5 mmHg decrease in MAP, the heart rate may increase by 2 beats per minute in an attempt to keep the MAP in check. However, there is a lower limit ("minimum pressure"), after which these controls are no longer effective. Once the MAP reaches the baroreceptor minimum pressure, there is no additional increase in heart rate if the pressure continues to fall. For example, should the pressure continue to fall, the heart rate would not show a corresponding increase.

The MAP set-point is exactly between baroreceptor maximum pressure and baroreceptor minimum pressure.

Default: 72 mmHg

Range: 20 mmHg - 160 mmHg

Left Ventricle Contractility Factor

The **Left Ventricle Contractility Factor** parameter adjusts the contractility of the left ventricle and has a direct effect on cardiac output and blood pressure. Use this parameter to raise or lower the cardiac output.

Default: 1

Range: 0.10 - 10.00

Right Ventricle Contractility Factor

The **Right Ventricle Contractility Factor** parameter adjusts the contractility of the right ventricle and has a direct effect on pulmonary artery pressure and an inverse effect on central venous pressure. Use this parameter to raise or lower pulmonary artery pressure (PAP) or to change the central venous pressure (CVP).

Default: 1

Range: 0.10 - 10.00

Systemic Vascular Resistance Factor

The **Systemic Vascular Resistance Factor** parameter adjusts the baseline systemic vascular resistance. Raising the value increases the systemic vascular resistance while lowering the value decreases the vascular resistance.

Raising the parameter value is analogous to increasing the resistance to blood flow through the systemic vasculature. Under such conditions, the arterial blood pressure (ABP) increases, and the heart rate may decrease due to feedback from the physiological control mechanisms.

Default: 1

Range: 0.10 - 10.00

Venous Capacity Factor

The **Venous Capacity Factor** parameter adjusts the volume of blood contained in the unstretched venous system without an increase in venous pressure. Raising the value decreases the venous capacitance (vasodilatation and decreased vascular tone), while lowering the value increases the venous capacitance (vasoconstriction and increased vascular tone).

The volume of blood in the venous system has an inverse relationship to the blood pressure. Lowering the value is analogous to a "shift" in blood from the venous system to the arterial system, and this shift, when coordinated with increased systemic vascular resistance, results in an increase in blood pressure [arterial blood pressure (ABP), pulmonary artery pressure (PAP) and central venous pressure (CVP)].

Default: 1

Range: 0.10 - 100.00

Systemic Arteries Compliance Factor

The **Systemic Arteries Compliance Factor** parameter adjusts the pulse pressure (difference between systolic and diastolic pressures) of the simulated patient's systemic blood pressure. Increases in the compliance factor result in a decreased (narrower) pulse pressure, while smaller values increase the pulse pressure. Additionally, when the pulse pressure increases as a result of a reduced compliance factor, both systolic and diastolic pressures increase. Conversely, with a narrower pulse pressure (higher compliance factor), both the systolic and diastolic blood pressures also drop.

Default: 1

Range: 0.50 - 5.00

Pulmonary Arteries Compliance Factor

The **Pulmonary Arteries Compliance Factor** parameter adjusts the pulse pressure (difference between systolic and diastolic pressures) of the simulated patient's pulmonary blood pressure. Increases in the compliance factor decrease (narrow) the pulse pressure, while smaller values increase the pulse pressure. Additionally, when the pulse pressure increases as a result of a reduced compliance factor, both systolic and diastolic pulmonary pressures increase. Conversely, with a narrower pulse pressure (higher compliance factor) both the systolic and diastolic pulmonary pressures also drop.

Default: 1

Range: 0.20 - 5.00

Pulmonary Vasculature Resistance Factor

The **Pulmonary Vasculature Resistance Factor** parameter adjusts the baseline pulmonary vascular resistance. Raising the value increases the pulmonary vascular resistance, while lowering the value decreases the vascular resistance.

Raising the parameter value is analogous to increasing the resistance to blood flow through the pulmonary vasculature. Under such conditions, the pulmonary artery pressure (PAP) and central venous pressure (CVP) increase due to back-pressure through the right side of the heart.

Default: 1

Range: 0.10 - 10.00

Venous Return Resistance Factor

The **Venous Return Resistance Factor** parameter adjusts the resistance between the extrathoracic and intrathoracic venous compartments. Raising the value increases the resistance, while lowering the value decreases the resistance.

With less blood returning to the heart, there is a reduced volume entering the ventricles prior to ventricular contraction. This results in a drop in the cardiac output and decrease in arterial blood pressures. The heart rate increases due to feedback from the physiological control mechanisms in an attempt to maintain adequate blood pressures.

Default: 1

Range: 0.10 - 100.00

Baroreceptor Gain (Overall) Factor

The **Baroreceptor Gain (Overall) Factor** parameter adjusts the influence of mean arterial pressure (MAP) on heart rate, contractility, systemic vascular resistance and venous capacity. Use this parameter to adjust how vigorously the heart and vasculature respond to blood pressure changes. The degree of increase in heart rate or vascular response is influenced by the baroreceptor gain (overall) factor.

For example, when blood pressure falls, the heart rate increases, the arteries increase their vascular tone (resistance) and there is less pooling of the blood in the venous system, all in an attempt to maintain adequate blood pressure. A baroreceptor gain (overall) factor value of less than 1 corresponds to baroreceptor depression. A baroreceptor gain (overall) factor value greater than 1 leads to a stronger response to MAP changes.

Default: 1

Range: 0.00 - 100.00

Baroreceptor Gain (Cardiac) Factor

The **Baroreceptor Gain (Cardiac) Factor** parameter selectively adjusts the influence of mean arterial pressure (MAP) on the heart rate and contractility influencing how much the heart rate increases or decreases with changes in blood pressure. Use this parameter to adjust how vigorously the heart responds to blood pressure changes.

A baroreceptor gain (cardiac) factor of less than 1 corresponds to baroreflex depression (e.g., less heart rate response to MAP changes). A value greater than 1 leads to a stronger response to MAP changes.

Default: 1

Range: 0.00 - 10.00

Baroreceptor Gain (Peripheral) Factor

The **Baroreceptor Gain (Peripheral) Factor** parameter adjusts the influence of mean arterial pressure (MAP) on systemic vascular resistance and venous capacity influencing how much the vasculature responds to changes in blood pressure.

For example, when blood pressure falls, the arteries increase their vascular tone (resistance), and there is less pooling of the blood in the venous system, in an attempt to maintain adequate blood pressure. A factor of less than 1 corresponds to baroreflex depression (e.g., less systemic vascular resistance response to MAP changes). A value greater than 1 leads to a stronger response to MAP changes.

Default: 1

Range: 1.00 - 10.00

Chest Compression Efficacy

The **Chest Compression Efficacy** parameter is used to determine the effectiveness of the chest compression administered by the caregiver. The 100% setting indicates that chest compressions are completely effective, while the 0% setting prevents them from having any effect on intrathoracic pressure.

Default: 100%

Options: 100%
0%

Tamponade Volume

The **Tamponade Volume** parameter is used to set the amount of fluid or blood that is building up in the space between the myocardium and the pericardium, causing a cardiac tamponade.

Default: 0 mL

Range: 0 mL - 500 mL

Ischemic Index Sensitivity

The **Ischemic Index Sensitivity** parameter determines the relative sensitivity of the simulated patient to myocardial ischemia. A lower ischemic index sensitivity value corresponds to less sensitivity to an unfavorable oxygen supply/demand ratio (i.e., poor oxygenation with high heart rate). A patient with a low value is less sensitive to poor oxygenation, takes longer to go into the "death spiral" and, therefore, survives longer.

Default: 0.45

Range: 0.10 - 5.00

Model-Driven ECG Rhythm	Ischemic Index (I.I.)
Normal Sinus Rhythm (NSR)	I.I. ≥ 0.90
Mild ST Segment Depression	0.90 > I.I. ≥ 0.70
Moderate ST Segment Depression	0.70 > I.I. ≥ 0.60
Premature Ventricular Contractions (PVCs)	0.60 > I.I. ≥ 0.40
Ventricular Tachycardia (VTach)	0.40 > I.I.
Ventricular Fibrillation (VFib)	1 minute after VTach
Asystole	1 minute after VFib

The patient's response to myocardial ischemia may be altered using the **Ischemic Index Sensitivity** parameter found on the Cardiovascular view. To make the patient less sensitive to ischemia, lower the value below the default setting. To make the patient more sensitive, increase the value above the default setting. These changes are then reflected in the patient's Ischemic Index, as shown in the table above.

Ischemic Index Averaging

Ischemic index averaging determines how quickly myocardial ischemia develops in the presence of an unfavorable oxygen supply/demand ratio or how rapidly it resolves when myocardial oxygenation becomes favorable. By decreasing the averaging time (i.e., value toward 0.5), ischemia has a faster onset if there is a poor oxygen supply to the heart or a faster resolution with favorable oxygenation. Increasing the averaging time (i.e., value toward 0.99) means ischemia takes longer to develop or longer to resolve.

Use this parameter to speed up the recovery from the model-driven "death spiral." By setting the parameter to 0.5, a patient pulls out of the "death spiral" at a faster rate than with a setting of 0.99. However, the favorable conditions (i.e., better oxygenation and/or lower heart rate) must exist before the number is made smaller. If not, the patient's descent increases at a faster rate.

Default: 0.99

Range: 0.50 - 1.00

Aortic Valve Resistance Factor

The **Aortic Valve Resistance Factor** parameter is used to adjust the resistance to blood flow across the aortic valve. Increasing the value to greater than 1 corresponds to increased resistance to blood flow through the aortic valve.

Default: 1

Range: 1 - 1000

Mitral Valve Resistance Factor

The **Mitral Valve Resistance Factor** parameter is used to adjust the resistance to blood flow across the mitral valve. Increasing the value to greater than 1 corresponds to increased resistance to blood flow through the mitral valve.

Default: 1

Range: 1 - 1000

Pulmonic Valve Resistance Factor

The **Pulmonic Valve Resistance Factor** parameter is used to adjust the resistance to blood flow across the pulmonic valve. Increasing the value to greater than 1 corresponds to increased resistance to blood flow through the pulmonic valve.

Default: 1

Range: 1 - 1000

Pericardiocentesis

The **Pericardiocentesis** parameter is used to activate and deactivate the pericardiocentesis hardware in the mannequin. The **Prime** option is used to prepare and drain the pericardiocentesis feature and has no physiologic impact.

Default: Disable

Options: Disable

Enable

Prime

Pulses

The table below shows the defaults and ranges for the pulses and pulse deficits for the HPS.

Pulse	Default	Range
Carotid (Left and Right)	On	N/A
Carotid Deficit	60	0 - 300
Left Brachial	On	N/A
Right Brachial	On	N/A
Brachial Deficit	80	0 - 300
Left Radial	On	N/A
Right Radial	On	N/A
Radial Deficit	90	0 - 300
Left Femoral	On	N/A
Right Femoral	On	N/A
Femoral Deficit	70	0 - 300
Left Popliteal/Pedal	On	N/A
Right Popliteal/Pedal	On	N/A
Popliteal/Pedal Deficit	80	0 - 300

All pulses, unless altered by an SCE, are enabled by default. To disable a pulse, click the pulse location on the human form. To enable a pulse, click the pulse location again. Click and hold a pulse location to adjust the pulse deficit.

Fluids

The blood droplet provides a means of controlling the amount of fluid lost by or infused into the patient. The amount of fluid to be lost or infused and the time frame during which the fluid loss or infusion takes place can be entered.

Fluid Parameters
Fluid Loss Blood
Fluid Loss Plasma
Colloid Infusion
Crystalloid Infusion
PRBC Infusion
Whole Blood Infusion
Urine Output
Bleeding

Fluid Loss Blood

When used, the **Fluid Loss Blood** parameter reflects a decrease in total blood volume. Blood loss proportionally decreases both the red blood cell volume and the plasma volume according to the current hematocrit.

Range: 0 mL - 4000 mL

Fluid Loss Plasma

When used, the **Fluid Loss Plasma** parameter reflects a decrease in plasma volume. Plasma loss decreases the plasma volume without changing the red blood cell volume. It refers collectively and generically to all fluid losses, including evaporative, transcellular, bowel and third space fluid losses.

Range: 0 mL - 4000 mL

Colloid Infusion

When used, the **Colloid Infusion** parameter reflects an addition to the plasma volume without changing the red blood cell volume. Colloids include modified fluid gelatin starch solutions, dextran and human albumin.

Range: 0 mL - 4000 mL

Crystalloid Infusion

When used, the **Crystalloid Infusion** parameter reflects an addition to the plasma volume without changing the red blood cell volume. The term crystalloid is used to describe salt solutions for infusion (e.g., normal saline, dextrose in water, Ringer's Lactate).

Range: 0 mL - 4000 mL

PRBC Infusion

Packed red blood cells are a preparation of 70% red blood cells and 30% liquid plasma, often administered in severe anemia to restore adequate levels of hemoglobin and red cells without overloading the vascular system with excess fluids.

Range: 0 mL - 4000 mL

Whole Blood Infusion

The term whole blood is used to refer to blood that has not been separated into its various components. It represents a preparation of 40% red blood cells and 60% liquid plasma.

Range: 0 mL - 4000 mL

Urine Output

This parameter is used to control the rate of urinary output. When fluid is set up for use with the genitourinary system and the genitourinary system is primed, setting **Urine Output** causes urine to flow from the mannequin at the specified rate. The **Urine Output** parameter does not affect the patient's physiology.

Range: 0 mL - 1000 mL

Bleeding

The **Bleeding** parameter is used to activate bleeding.

Default: Off

Sounds

A variety of simulated sounds are available to enhance realism. A patient must be running on the HPS for any sounds to be available.

Bowel Sounds

Bowel Sounds
Normal
Hypoactive
Hyperactive
None

Normal, **Hypoactive**, **Hyperactive** and absent bowel sounds (**None**) are selected using this parameter. Independent control of the type of bowel sounds may be selected in each anatomical region.

Bowel Sounds Locations
All Bowel Sounds
LUQ Bowel Sounds
RUQ Bowel Sounds
LLQ Bowel Sounds
RLQ Bowel Sounds

To affect the bowel sounds simultaneously in all anatomical regions, select the desired sound from the **Bowel Sounds** menu.

To change the amplitude of bowel sounds, adjust the volume slider below the **Bowel Sounds** menu.

Default: Normal

Breath Sounds

Normal and abnormal breath sounds are selected using this parameter. Breath sounds are synchronized with ventilation of the left and right lungs.

Breath Sounds
Normal
Crackles
Diminished
Wheezing

To change breath sounds, select the desired sound from the **Breath Sounds** menu.

Default: Normal

NOTE: The volume control slider may be used to adjust the amplitude of the sound. The volume control slider is only enabled while connected to a simulator.

Heart Sounds

Normal and abnormal heart sounds are selected using this parameter. Heart sounds are synchronized with the cardiac cycle.

Heart Sounds
Normal
S3
S4
S3 and S4
Early Systolic Murmur
Mid Systolic Murmur
Late Systolic Murmur
Pan Systolic Murmur
Late Diastolic Murmur

Default: Normal

NOTE: The volume control slider may be used to adjust the amplitude of the sound.

Microphone Volume

Microphone Volume is used to adjust the volume of sound coming from the wireless microphone. To increase or decrease the volume of the microphone, and thus the patient's voice, use the volume control slider.

Appendix C - Base Patients

The following pages describe the standard Müse base patients.

Stan D. Ardman II

Stan D. Ardman II is a healthy 33-year-old male. He demonstrates a HR in the 70s, BP in the 110s/70s, RR in the teens and SpO_2 in the upper 90s on room air. The patient's cardiac rhythm is model-driven normal sinus. Heart sounds are normal, breath sounds are clear in all lung fields and bowel sounds are normal in all four quadrants. The patient's weight is 70.0 kg.

GI Stan

GI Stan is a healthy 20-year-old male soldier. He demonstrates a HR in the 80s, BP in the 100s/70s, RR in the low teens and SpO_2 in the upper 90s on room air. The patient's cardiac rhythm is model-driven normal sinus. Heart sounds are normal, breath sounds are clear in all lung fields and bowel sounds are normal in all four quadrants. The patient's weight is 85.0 kg.

Grandma Smokey

Grandma Smokey is a 73-year-old female former smoker. She demonstrates a HR in the upper 80s, BP in the upper 140s/90s, RR in the teens and SpO_2 in the upper-mid 90s on room air. The patient's cardiac rhythm is right bundle branch block. Heart sounds are normal, breath sounds are clear in all lung fields and bowel sounds are normal in all four quadrants. The patient's weight is 53.0 kg.

Norma L. Female

Norma L. Female is a healthy 33-year-old female. She demonstrates a HR in the 70s, BP in the 110s/70s, RR in the teens and SpO_2 in the upper 90s on room air. The patient's cardiac rhythm is model-driven normal sinus. Heart sounds are normal, breath sounds are clear in all lung fields and bowel sounds are normal in all four quadrants. The patient's weight is 66.0 kg.

Stannette Momtobe

Stannette Momtobe is a 20-year-old pregnant female. She demonstrates a HR in the 80s, BP in the 100s/60s, RR in the mid teens and SpO_2 in the upper 90s on room air. The patient's cardiac rhythm is model-driven normal sinus. Heart sounds are normal, breath sounds are clear in all lung fields and bowel sounds are normal in all four quadrants. The patient's weight is 90.0 kg.

Stanley A. Wreck

Stanley A. Wreck is a hypertensive 61-year-old male. He demonstrates a HR in the 70s, BP in the 180s/100s, RR in the mid teens and SpO_2 in the mid 90s on room air. The patient's cardiac rhythm is model driven normal sinus. Heart sounds are normal, breath sounds are clear in all lung fields and bowel sounds are normal in all four quadrants. The patient's weight is 100.0 kg.

Appendix D – The Ischemic Index (Death Spiral)

The Ischemic Index is a measure of the myocardial ischemia modeled using classical determinants. When an unfavorable oxygen supply/demand ratio occurs, myocardial ischemia follows. The lower the Ischemic Index, the greater the myocardial ischemia. The Ischemic Index is derived through the underlying physiological models and cannot be measured clinically.

Favorable supply/demand ratios (slower heart rates, higher blood oxygenation levels) generally result in a higher Ischemic Index value, whereas unfavorable supply/demand ratios (faster heart rates, lower blood oxygenation levels) generally result in a lower Ischemic Index value.

The patient's Ischemic Index value can be viewed by selecting the Ischemic Index widget from the Patient Status Display. F*or more information on selecting Patient Status Display widgets, see* ***Using the Patient Status Display*** *beginning on page 60.*

The table below lists Ischemic Index values and their corresponding patient conditions.

Model-Driven ECG Rhythm	Ischemic Index (I.I.)
Normal Sinus Rhythm (NSR)	I.I. ≥ 0.90
Mild ST Segment Depression	0.90 > I.I. ≥ 0.70
Moderate ST Segment Depression	0.70 > I.I. ≥ 0.60
Premature Ventricular Contractions (PVCs)	0.60 > I.I. ≥ 0.40
Ventricular Tachycardia (VTach)	0.40 > I.I.
Ventricular Fibrillation (VFib)	1 minute after VTach
Asystole	1 minute after VFib

The patient's response to myocardial ischemia may be altered using the **Ischemic Index Sensitivity** parameter found in the **Cardiovascular** view. To make the patient less sensitive to ischemia, lower the value below the default setting. To make the patient more sensitive, increase the value above the default setting.

*For more information about the Ischemic Index parameters (****Ischemic Index Sensitivity*** *and* ***Ischemic Index Averaging****), see* ***Appendix B - Müse Parameter Descriptions****.*

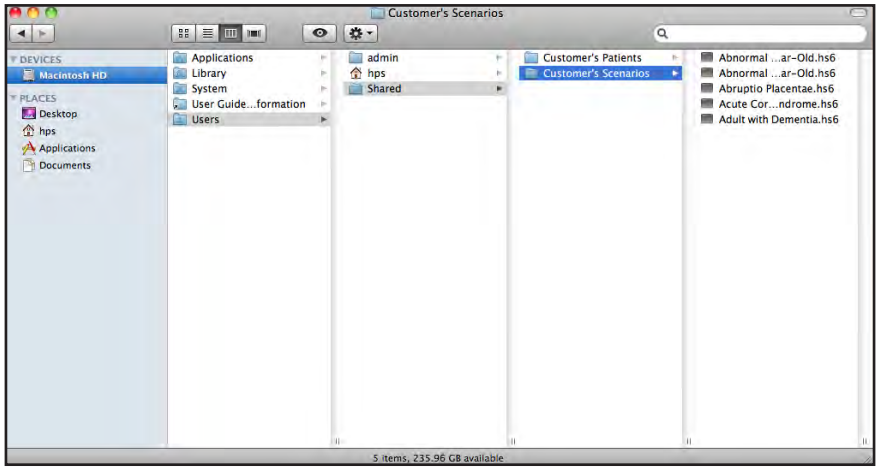
Appendix E - hs6 Files and Müse

If you had HPS6 software prior to obtaining Müse for HPS, you can export your old **hs6** files and import them to the new Instructor Workstation. This document shows how to remove **hs6** scenarios from the former Instructor Workstation, install them on the Müse software and convert the files for use with Müse. The examples shown apply to any hs6 file being converted into Müse.

NOTE: **hs6** information can be transferred to external storage via a CD or a USB memory device.

Locating hs6 Files

By default, custom scenario files are stored in the preset /Users/Shared folder on the Instructor Workstation's hard drive. However, files can be stored in any folder on the hard drive.



Locating an hs6 File

Moving Files Using a USB Memory Device

Saved files can be moved to another computer using a USB memory device.

To transfer files using a USB memory device:

1. Insert the USB memory device into an available USB port on the Instructor Workstation. An icon appears on the desktop indicating that the memory device has been recognized.

USB Memory Device Icon

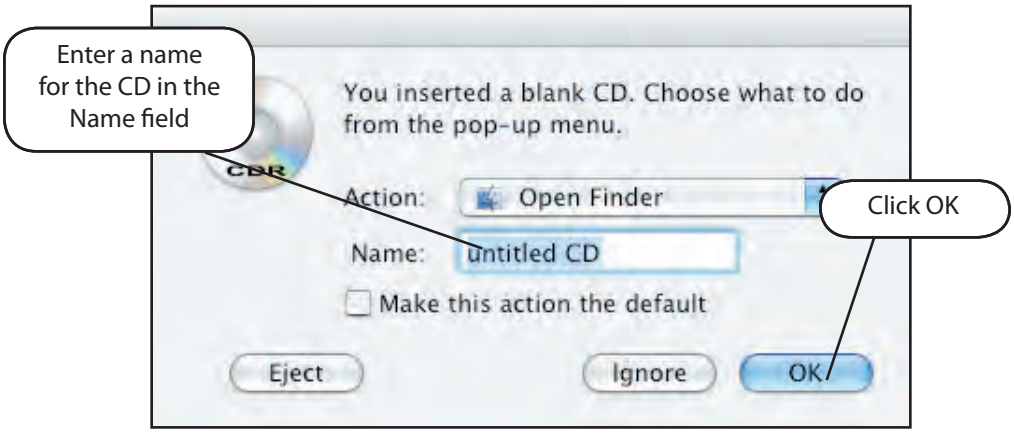
2. Locate the appropriate folder on the hard drive containing the file(s) to be saved.
3. Drag the file(s) from the folder on the hard drive to the memory device icon on the desktop. The files are copied automatically onto the device.
4. Double-click the memory device icon to open the window for the device and confirm the files have been copied.
5. Drag the icon to the Trash to disconnect the memory device.
6. Remove the memory device from the USB port.

Moving Files Using a CD

Saved files can be moved to another computer using a CD.

To transfer files using a CD:

1. Insert a blank CD in the CD drive on the side of the Instructor Workstation. A dialog box appears with a **Name** field for labeling the CD.



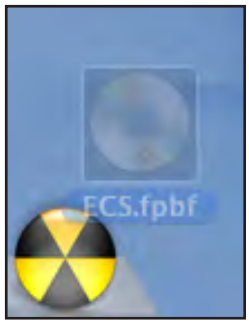
Naming the CD

2. Enter the new name in the **Name** field (overwriting the default name).
3. Click **OK**.
4. Locate the folder with the information you wish to save.
5. Select the appropriate files from the drive and drag them to the CD.

Dragging Files to a CD

6. Double-click the CD icon to open the window for the CD and confirm the files have been copied.

7. Drag the CD file to the Trash icon on the Dock. When the CD file is over the Trash, the icon changes to a Burn CD icon.



Burn CD Icon

A dialog box appears with the options to **Burn**, **Cancel** or **Eject**.

Are you sure you want to burn the contents of "ECS" to a disc?
You can use this disc on any Mac or Windows computer. To eject the disc without burning it, click Eject.
Disc Name: ECS
Burn Speed: 24x (faster)
Save Burn Folder To: ECS
Eject
Cancel
Burn

Burn CD Dialog

Click the **Burn** button on the dialog box. Once burning is complete, the CD icon reappears on the desktop.

To remove the CD from the CD drive, drag the CD file to the Trash icon in the Dock. The icon changes to an Eject icon, and the CD is ejected.

CDs can also be ejected by selecting the CD icon and choosing the **Eject** option from the Finder's **File** menu or by pressing the **Eject** key.

Transferring hs6 Files to a New Instructor Workstation

Once the **hs6** files have been copied, they can then be placed on the new computer in a desired location.

To import the **hs6** files, insert the CD or USB Device into the Instructor Workstation and drag and drop the files into the desired location. The files are ready to use.

Importing HPS6™ Scenarios

To import **hs6** files into Müse:

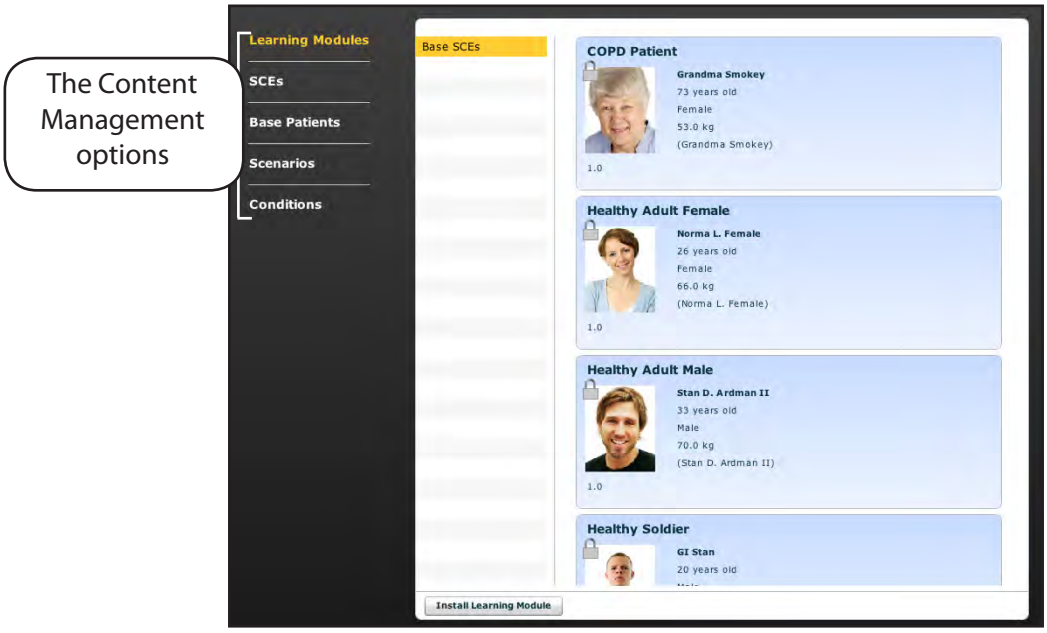
1. Log into the Müse software. The Home Page appears.

The Home Page

2. From the Home Page, click the **System Administration** button.

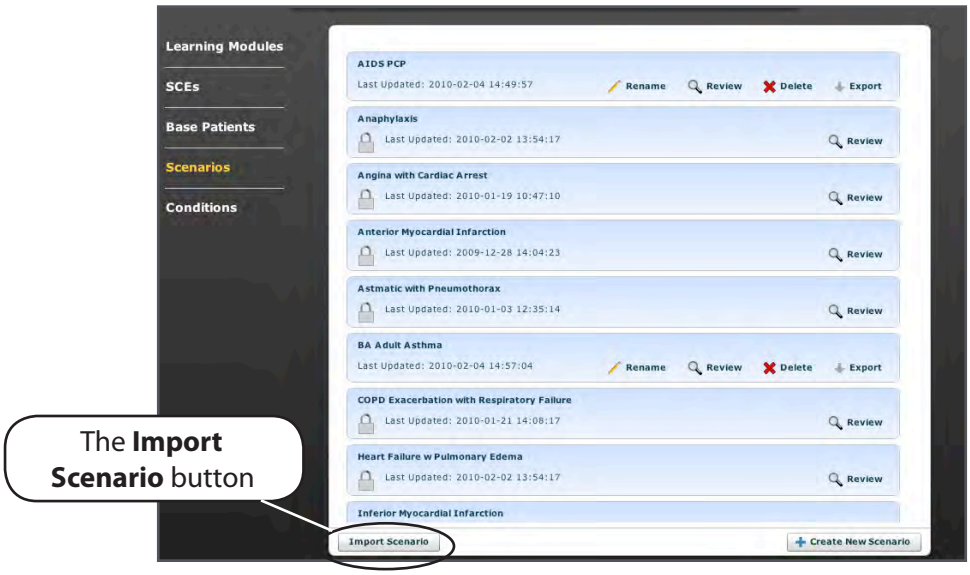
The System Administration Button

The System Administration screen appears showing the Content Management options.



The Content Management Options

3. Click **Scenarios**. The Scenarios panel appears.



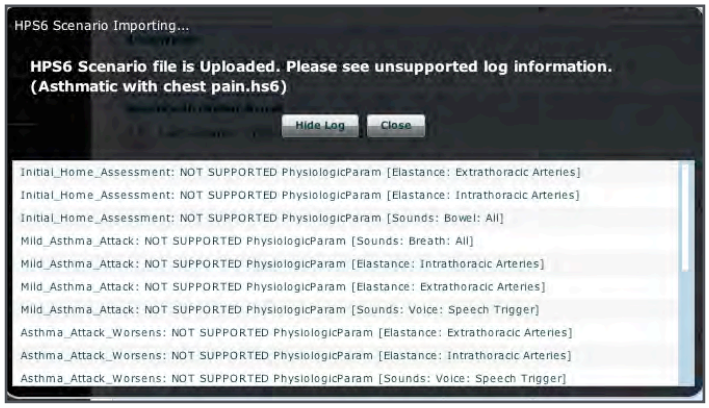
The Scenarios Panel

4. From the Scenarios panel, click the **Import Scenarios** button. A Finder window appears.
5. From the Finder window, locate the desired **hs6** scenario file and click on it.

Locating the .hs6 Scenario File

NOTE: Only **hs6** files can be imported. To import a **.gas** file, the scenario must be converted in the HPS6 software first.

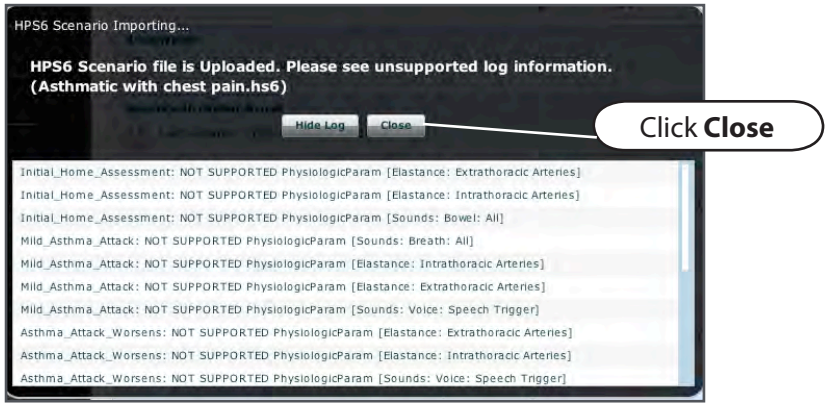
6. Once the file has been located, from the Finder window, click **Select**. The scenario loads and produces an Unsupported Log Information dialog box.


HPS6 Scenario Importing...
HPS6 Scenario file is Uploaded. Please see unsupported log information.
(Asthmatic with chest pain.hs6)
Hide Log
Close
Initial_Home_Assessment: NOT SUPPORTED PhysiologicParam [Elastance: Extrathoracic Arteries]
Initial_Home_Assessment: NOT SUPPORTED PhysiologicParam [Elastance: Intrathoracic Arteries]
Initial_Home_Assessment: NOT SUPPORTED PhysiologicParam [Sounds: Bowel: All]
Mild_Asthma_Attack: NOT SUPPORTED PhysiologicParam [Sounds: Breath: All]
Mild_Asthma_Attack: NOT SUPPORTED PhysiologicParam [Elastance: Intrathoracic Arteries]
Mild_Asthma_Attack: NOT SUPPORTED PhysiologicParam [Elastance: Extrathoracic Arteries]
Mild_Asthma_Attack: NOT SUPPORTED PhysiologicParam [Sounds: Voice: Speech Trigger]
Asthma_Attack_Worsens: NOT SUPPORTED PhysiologicParam [Elastance: Extrathoracic Arteries]
Asthma_Attack_Worsens: NOT SUPPORTED PhysiologicParam [Elastance: Intrathoracic Arteries]
Asthma_Attack_Worsens: NOT SUPPORTED PhysiologicParam [Sounds: Voice: Speech Trigger]

The Unsupported Log Information Dialog Box

This dialog box appears to let users know not all of the data transferred accurately.

7. Click **Close**.


HPS6 Scenario Importing...
HPS6 Scenario file is Uploaded. Please see unsupported log information.
(Asthmatic with chest pain.hs6)
Hide Log
Close
Click Close
Initial_Home_Assessment: NOT SUPPORTED PhysiologicParam [Elastance: Extrathoracic Arteries]
Initial_Home_Assessment: NOT SUPPORTED PhysiologicParam [Elastance: Intrathoracic Arteries]
Initial_Home_Assessment: NOT SUPPORTED PhysiologicParam [Sounds: Bowel: All]
Mild_Asthma_Attack: NOT SUPPORTED PhysiologicParam [Sounds: Breath: All]
Mild_Asthma_Attack: NOT SUPPORTED PhysiologicParam [Elastance: Intrathoracic Arteries]
Mild_Asthma_Attack: NOT SUPPORTED PhysiologicParam [Elastance: Extrathoracic Arteries]
Mild_Asthma_Attack: NOT SUPPORTED PhysiologicParam [Sounds: Voice: Speech Trigger]
Asthma_Attack_Worsens: NOT SUPPORTED PhysiologicParam [Elastance: Extrathoracic Arteries]
Asthma_Attack_Worsens: NOT SUPPORTED PhysiologicParam [Elastance: Intrathoracic Arteries]
Asthma_Attack_Worsens: NOT SUPPORTED PhysiologicParam [Sounds: Voice: Speech Trigger]

The Unsupported Log Information Dialog Box

The scenario appears in the Scenarios panel.

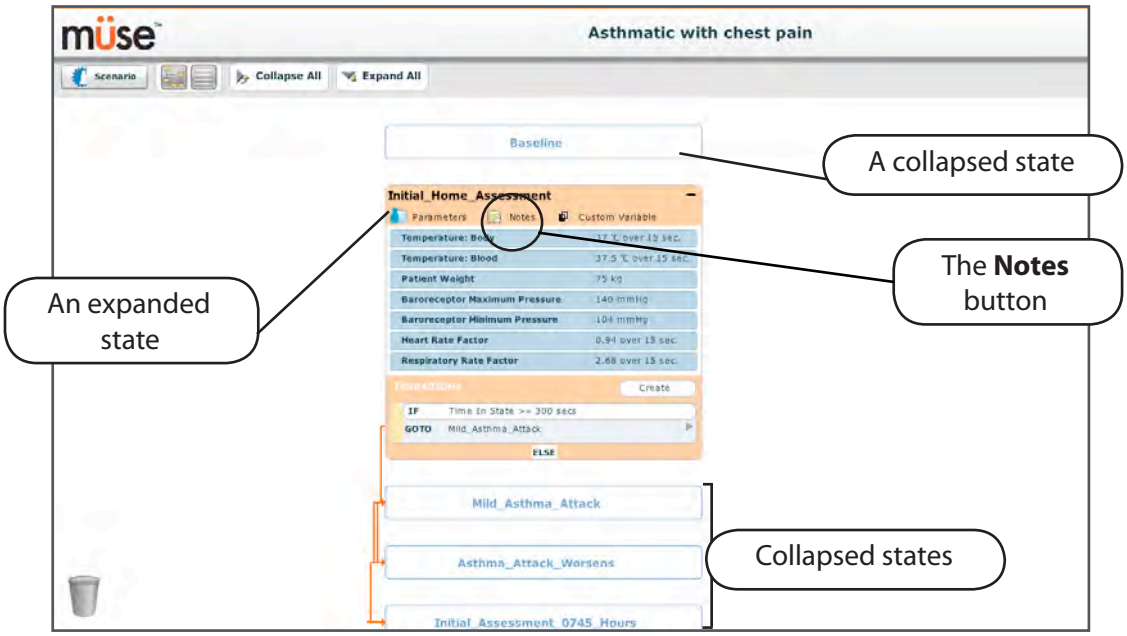
An Imported Scenario

8. Click the **Review** button of the imported scenario to review the scenario.

The Review Button of a Scenario in the Scenario Panel

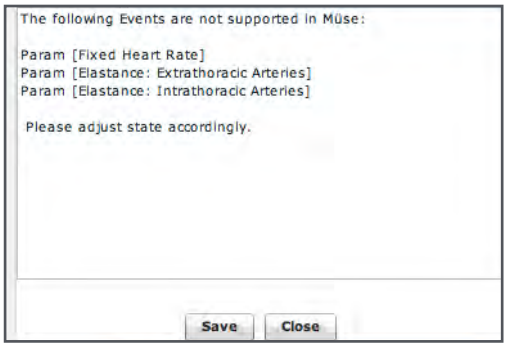
The Scenario Designer appears.

9. Focusing on one state at a time, double-click each state to expand it.



Expanding States in the Scenario Designer

10. Click the **Notes** button of each state one at a time. The State notes for each State appear listing all the items that did not convert and/or transfer from the import.



Unsupported Scenario Items

11. Click the **Close** button to exit the State notes, or enter changes to the State notes and click the **Save** button.
12. As desired, alter the scenario in the Scenario Designer to coincide with the Müse software.

Appendix F - Configuring the HPS Gas Analyzer

The gas analyzer located in the HPS rack is an integral component controlling the anesthetic vapor within the lungs. The volatile agents recognized by the system are sevoflurane, isoflurane, enflurane and halothane.

IMPORTANT: Isoflurane is set as the default agent recognized by the gas analyzer. To assign a different volatile agent to the gas analyzer and ensure proper performance use the Rack Edit utility.

RackEdit is a supporting application designed to configure specific parameters of the HPS Rack. It is distributed as a supporting utility application along with the HPS Version 6 software, which is located on the Mac Instructor Workstation. The utility allows the user to assign an anesthetic agent type to the gas analyzer.

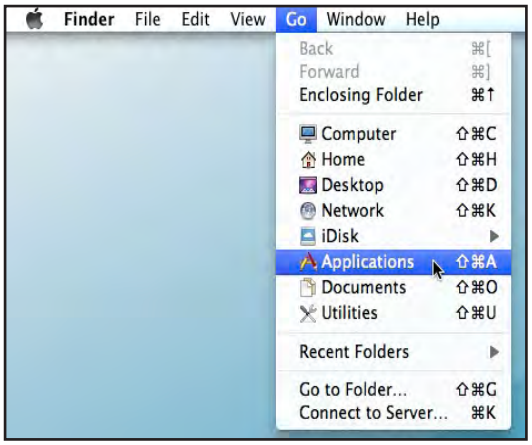
Requirements

- Macintosh Computer with Mac OS X 10.2.8 or higher
- HPS Simulator (HPS Rack to be configured)

Using the RackEdit Utility

To begin configuring the gas analyzer:

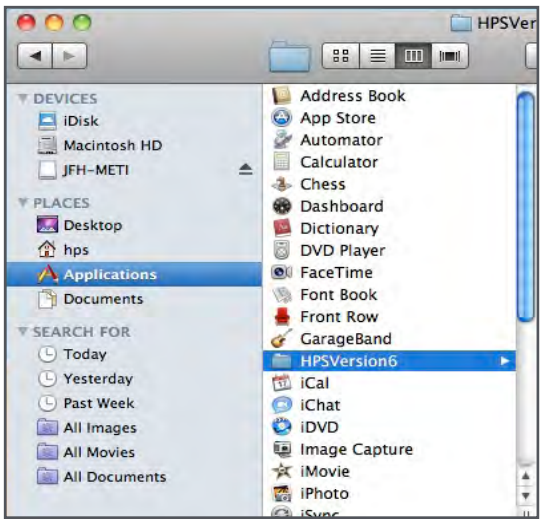
1. From the HPS workstation, click on the Desktop to make the **Finder** application active.
2. From the Finder menu bar, click **Go**.



The Finder Menu

3. Click on **Applications**.

The Applications Window appears.



The Applications Window

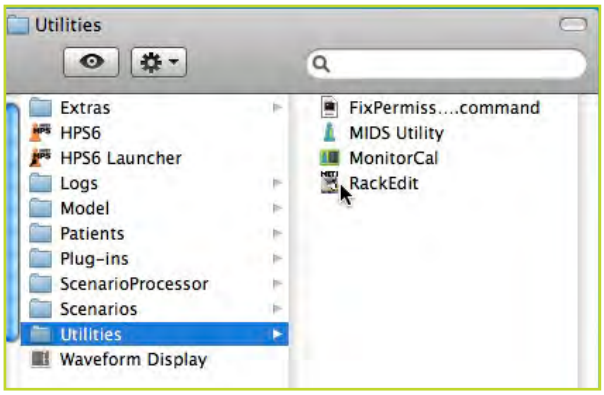
4. Scroll down and click on the **HPSVersion6** folder.

   The corresponding list of options appear.

The Applications Window

5. Select the **Utilities** folder.

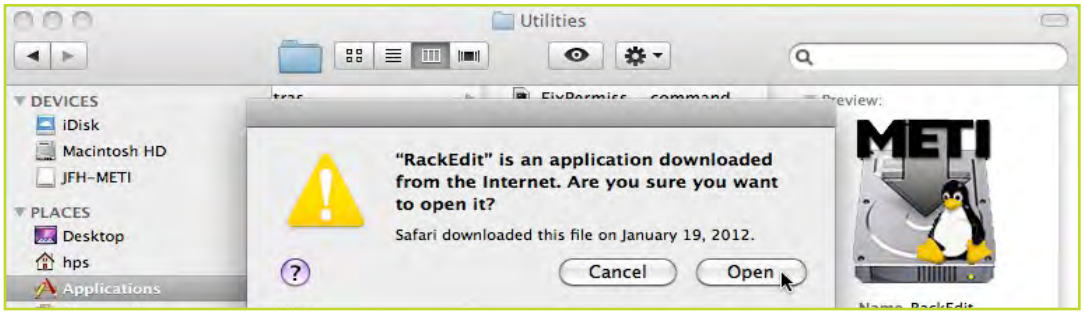
The Utility Options appear.



The Applications Window

6. Double-click on the **RackEdit** icon.

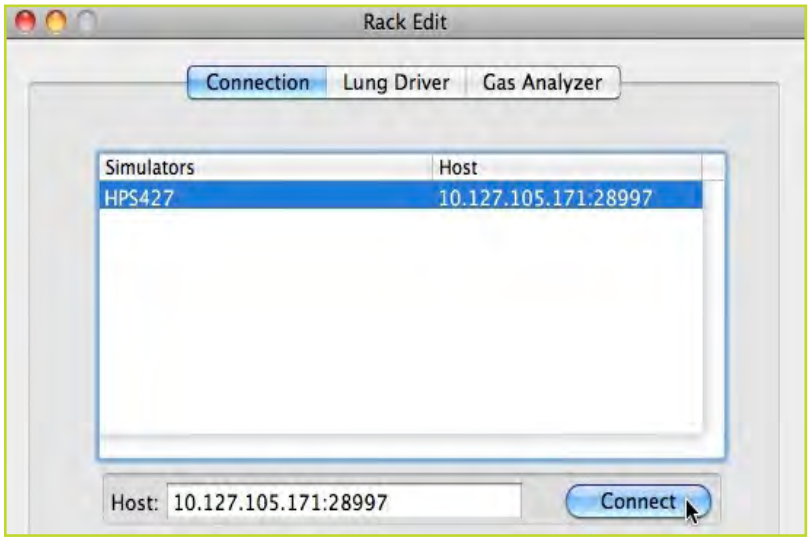
   A Warning message may appear to ensure the application is to be opened.



The "Rack Edit" Warning Message

7. If the Warning Message appears, click **Open** to load the Rack Applicator.
8. To exit the Applications window, click the red **Close** button in the upper left corner of the Utilities window.

Once loaded, the RackEdit Application window will appear.



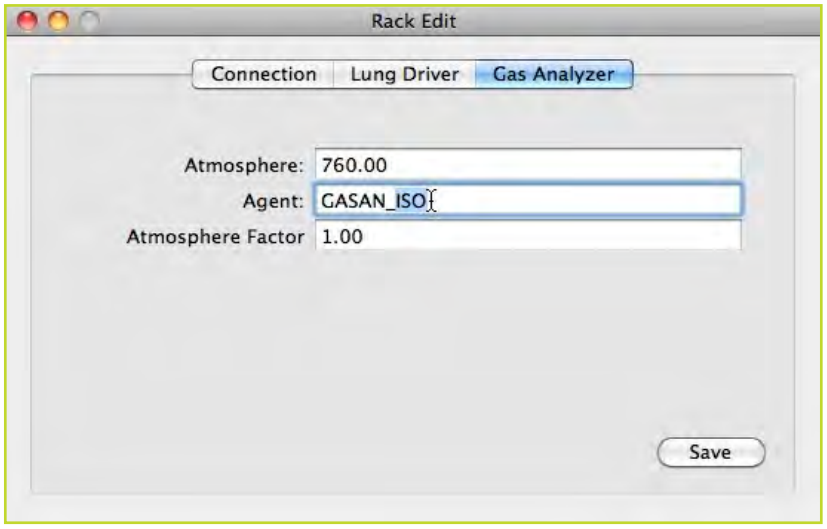
The Rack Application Window

9. Select the desired simulator from the list and click **Connect**.

   NOTE: Once a connection to the simulator is established, the **Connect** button becomes the **Disconnect** button.

10. Click on the **Gas Analyzer** tab.

The currently configured agent name appears.



The Rack Application Window

11. To change the agent configuration, select the existing agent name and replace it with one of the available agents for the Gas Analyzer:

    GASAN_ISO, GASAN_SEVO, GAS_ENF and GASAN_HALO

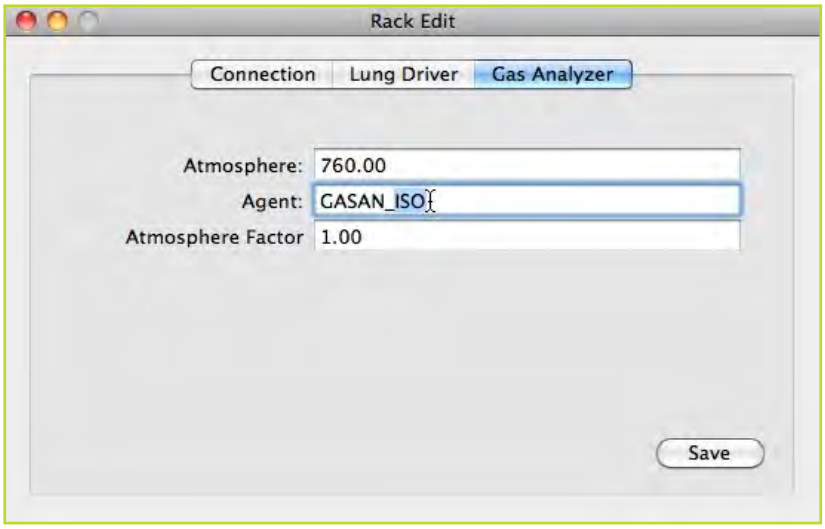
12. Ensure that the desired agent name is entered correctly, including the underscore between GASAN and the agent abbreviation.

    NOTE: The fields for Atmosphere and Atmosphere Factor are factory presets and should not be altered by the customer.

Saving Changes to the Gas Analyzer

To Save the desired change once the new agent has been chosen and entered:

1. Stay on the Rack Edit window after having made the change.

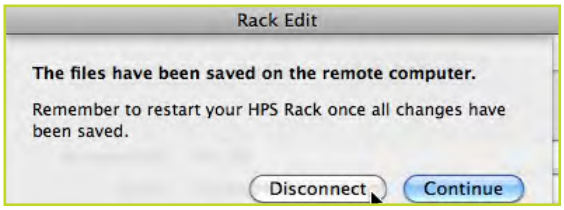


The Rack Application Window

2. Click the **Save** button to save your configuration changes.

NOTE: If the application is terminated or the HPS rack is disconnected before saving, the changes will be lost and the original values retained.

Once the values are saved, a dialog box appears.

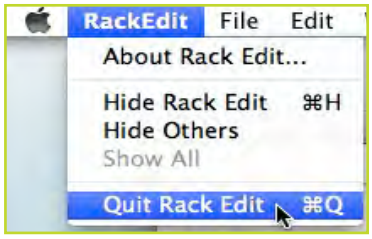

Rack Edit
The files have been saved on the remote computer.
Remember to restart your HPS Rack once all changes have been saved.
Disconnect
Continue

The Values Saved dialog box

3. Click **Disconnect** to disconnect from the HPS Rack.

   The Rack Edit window automatically returns to the **Connection** window.

4. Click on **Quit Rack Edit** in the task bar



The Rack Edit Drop down Menu

5. To close the RackEdit Utility, select **Quit Rack Edit**.

   IMPORTANT: Power down and restart the HPS system for the changes to take effect.

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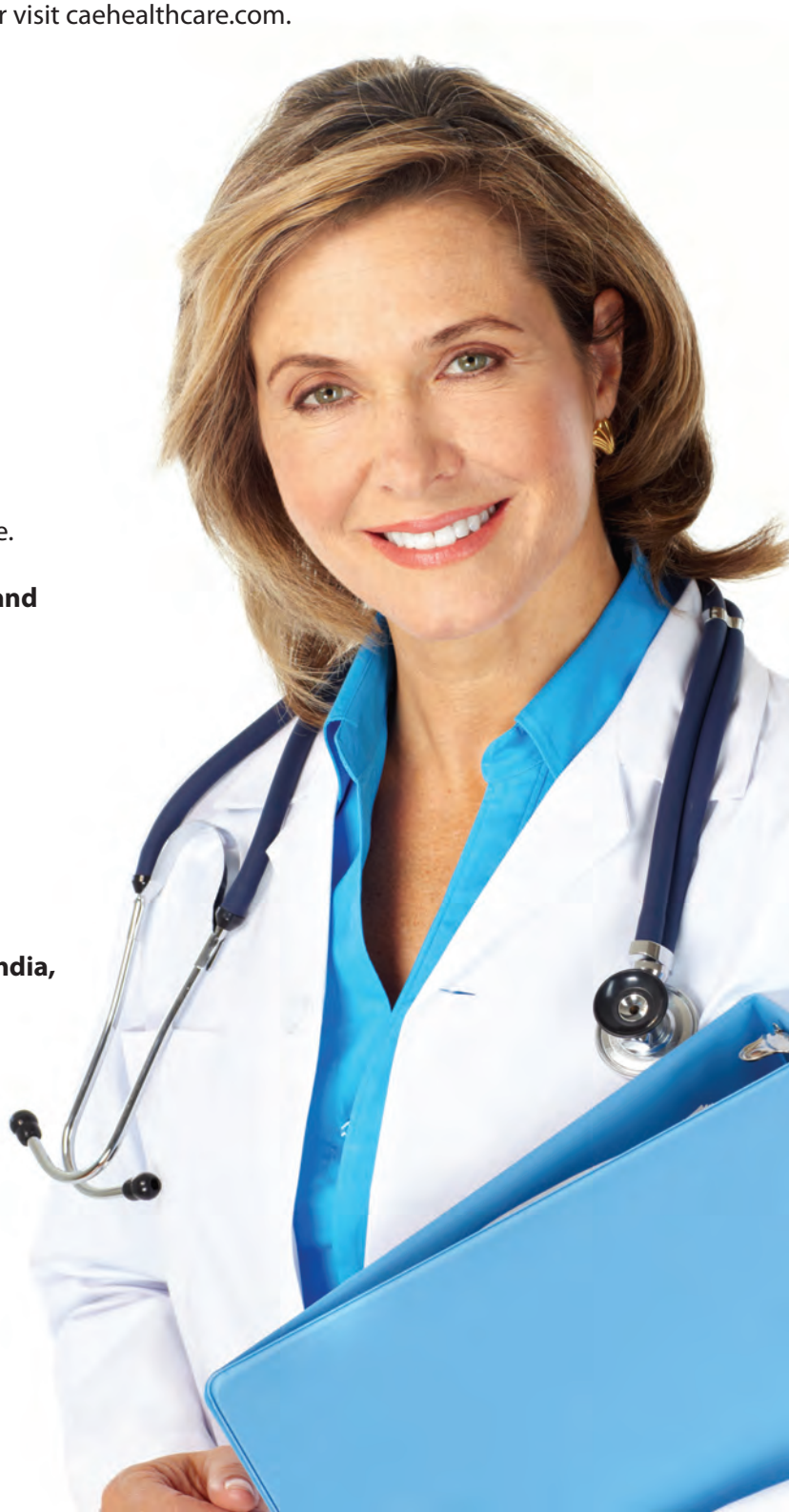

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